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GEOLOGY.—*The Murphree Valley anticline, Alabama.*[1] GEORGE W. STOSE, U. S. Geological Survey.

In studying the manganese deposits of Walnut Grove, Ala., surveyed for the U. S. Geological Survey in 1942, I had occasion to map the north end of the Murphree Valley anticline, from Oneonta northeastward. As the structure of this fold differs in direction of overturning and thrusting from typical broken folds of the Southern Appalachians, it was the subject of discussion at a meeting of geologists of the Southern States held at the University of Kentucky, Lexington, Ky., March 23–25, 1950. Therefore I wish to record my determination of the structure.

This anticline in the Appalachian Plateau is an exception to structures common to the Southern Appalachian region in that it is overturned to the southeast and is bordered on its southeast side by a thrust fault that is steeply inclined to the northwest. This structure was so shown on the section in the Gadsden Folio of the Geologic Atlas of the United States (Hayes, 1896), on a section of the Geologic Map of Alabama (Butts, 1926), and in other reports. The rocks at the surface that are involved in the structure range in age from Upper Cambrian to Pennsylvanian, and the succession of formations is shown in the legend of the map, Fig. 1. The terminology used is that of Butts (1926) rather than that of Hayes (1896). The formations, in descending order, are briefly characterized in the following description.

A sandstone unit at the base of the Pottsville formation of Pennsylvanian age (the Lookout sandstone of Hayes) forms the ridges that border the anticline—Sand Mountain on the northwest border and Raccoon Mountain, which passes northeastward into Straight Mountain, on the southeast. The Pennington shale of Mississippian age underlies the Pottsville, and is very thin in this part of Alabama. In the Murphree Valley this formation is partly sandstone. The Bangor limestone is a fossiliferous, cliff-making limestone about 600 feet thick. Fossils collected from it include *Pentremites*, *Archimedes*, zaphrentoid corals, gastropods, and brachiopods of Chester age. The Tuscumbia limestone, largely weathered to clay and chert, in this area contains many lentils and thick beds of sandstone (Fig. 1), including one northwest of Walnut Grove that makes a cliff 60 feet high. Such lentils were evidently formed by detrital matter from deltas of streams that entered the sea in this vicinity. Many specimens of *Fenestella* and branching bryozoans, of St. Louis age, are present in the formation, and the base is marked by beds that contain *Lithostrotionella* (*Lithostrotion canadense* of old reports). The Fort Payne chert, the manganese-bearing formation of the area, is characterized by many large crinoid segments and large spirifers of Keokuk age. Probably some fossiliferous chert of the overlying Tuscumbia has been included in the mapping of the Fort Payne chert, especially in the area northeast of Aurora, where beautifully preserved bryozoans, including fenestellas of Warsaw age, were collected. The Fort Payne chert, about 200 feet thick, is composed of interbedded chert and limestone, commonly with a prominent sandstone at the base. The limestone has weathered to clay, which contains the manganese deposits. These deposits are limited in distribution to about 5 miles along the strike of the formation.

[1] Publication authorized by the Director, U. S. Geological Survey.

FIG. 1.—Geologic map of northern part of Murphree Valley anticline, Alabama.

The ore is in thin beds, which swell to 6 inches in places. Most of the commercial ore is pulverulent pyrolusite of high grade. A limestone 55 feet thick, locally present in the lower part of the formation northwest of Oneonta, resembles limestone described by Butts (1926, p. 164) from Lauderdale County, from which he identified fossils of Burlington age. Fossils collected in this limestone in the Murphree Valley northwest of Oneonta were briefly examined by J. S. Williams of the U. S. Geological Survey, who states that they appear to be of post-Burlington age, possibly Keokuk.

The Chattanooga shale, 20 to 40 feet in thickness, is chiefly black carbonaceous shale containing linguloid shells and conodonts, which Ulrich considered to be identical with forms that occur in the Sunbury shale of Ohio and therefore of Carboniferous age (Ulrich, 1911, pl. 28 and p. 527). Unfossiliferous gray sandy beds in the lower part of the formation may be Devonian in age. The Red Mountain formation, which forms Red Mountain, lies directly beneath the Chattanooga shale and crops out near the center of the anticline. As its name implies, the formation is red, owing to the presence of hematite and red shale of Clinton age. The underlying Chickamauga limestone is largely a pure limestone and includes beds ranging in age from Maysville to "Stones River" (Chazyan) (Ulrich, 1911, pl. 27 and pp. 566–567). At the base are dark limestones that contain bryozoans, brachiopods, and gastropods, which Ulrich regarded as the Stones River fauna. The Copper Ridge dolomite lies in the lowland of the valley, where it is weathered to clay and chert. No fossils were collected from it. Butts (1926) refers the formation to the Upper Cambrian. At Chepultepec (now Allgood) on the west side of the Murphree Valley, about 5 miles southwest of Oneonta, fossils of Lower Ordovician age were collected by Ulrich from chert of the Chepultepec dolomite which overlies the Copper Ridge dolomite. The Chepultepec dolomite was not observed in the area shown in the map, Fig. 1, but is probably present. Thin-bedded limestones that are exposed near the village of Murphree Valley weather to buff and light-colored earthy shale and tripoli and closely resemble the limestones of the Elbrook formation of Virginia and farther north. These rocks are tentatively mapped as Conasauga formation.

From Oneonta northeastward the fault in the Murphree Valley is on the southeast side of the anticline, and lies between the Copper Ridge dolomite on the west and the Pottsville formation on the east. At Allgood Gap in Raccoon Mountain, southeast of Oneonta, the Pottsville at the fault is vertical and the Copper Ridge dolomite is exposed in the adjacent lowland to the west. The Pottsville formation of Straight Mountain, southeast of Walnut Grove, also stands vertical at the fault, but away from the fault it rapidly assumes a gentle southeast dip. A mile and a half southeast of Aurora the fault passes into lower beds of the anticline and dies out in the northeast plunging end. Southwest of Oneonta the fault similarly passes into lower beds of the anticline, which here plunges southwestward, as shown on the Alabama geological map (Butts, 1926). The exposures southeast of Aurora, where the thrust passes into lower beds in the anticline, furnish the best place to study the fault. A mile south of Aurora the fault leaves the contact with the Pottsville formation and passes into lower beds in the anticline, through Pennington shale,

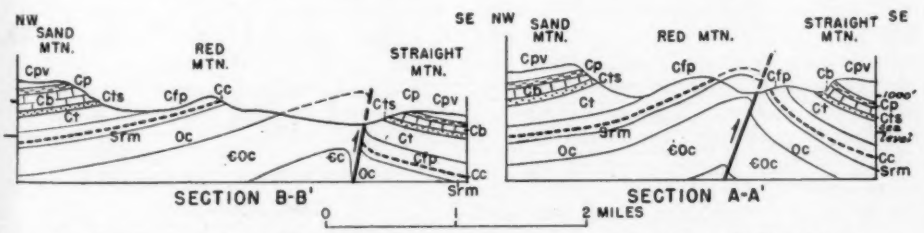

FIG. 2.—Cross-sections of Murphree Valley anticline on the lines A–A′ and B–B′ of Fig. 1.

Bangor limestone, Tuscumbia limestone, Fort Payne chert, Chattanooga shale, into the Red Mountain formation, where displacement dies out to the northeast. The mapping of this part of the fold on the geological map of Alabama (Butts, 1926) evidently was copied from Hayes' mapping, and the changes shown are probably due to inaccuracies of copying and not to correction by Butts. The same is probably true of the fault on the southeast side of the Murphree Valley on section B-B′ of that map, which is shown by Butts—much less steep than by Hayes.

The strata exposed near the fault along and adjacent to the road northeast from Aurora (Figs. 1 and 2-AA′) are mostly vertical, and at one place the Red Mountain formation just east of the fault is overturned and dips 45° NW. The Chickamauga limestone, which crops out northwest of the fault, is also overturned and dips 65° NW. The fault plane is nowhere exposed, but at the plunging end of the anticline the beds close to the fault are seen to be largely vertical or are overturned and dip steeply northwestward, and the fault probably has a similar steep dip. The fold and the thrust are believed by the writer to be superficial, produced by the abrupt upbowing of the Copper Ridge dolomite, which is the competent bed that directly underlies this part of the anticline.

The Murphree Valley anticline is an uplift in the Appalachian Plateau between the Sequatchie-Browns Valley anticline to the northwest and the Wills Valley anticline to the southeast (Fig. 3). The bordering synclines are nearly flat, wide folds of gently rolling Carboniferous rocks, from which the three narrow, straight anticlines rise abruptly and are exposed in narrow valleys carved in the plateau surface. They lie just west of the Allegheny Front and west of the Appalachian folded belt. These anticlines are believed by the writer to have been formed by the abrupt yielding to pressure and the local upbowing of the thick Copper Ridge dolomite, the competent bed that transmitted the thrust from its source to the southeast. Each of the three anticlines is broken by a thrust fault along its trend. The rocks of the Sequatchie-Browns Valley anticline and the Wills Valley anticline have steeper dips on their northwest sides where they are broken by thrust faults dipping steeply southeastward. The Murphree Valley anticline also is broken by a thrust fault on its steeper side, which, however, is the southeast side. The Copper Ridge dolomite beneath the Carboniferous rocks of the synclines is nearly horizontal and transmitted the thrust in a horizontal direction. I believe that the dolomite bowed up into sharp, steep anticlines, while the underlying, nonresistant shaly Conasauga formation yielded to the pressure by crumpling. The anticlines and the thrust faults, therefore, are superficial, probably no deeper than the Copper Ridge dolomite. The vertical attitude of the beds near the fault indicates that the thrust faults are more in the nature of upthrusts than overthrusts. Because the thrust, transmitted through the Copper Ridge dolomite beneath the synclines, has a horizontal direction, it yielded upward toward

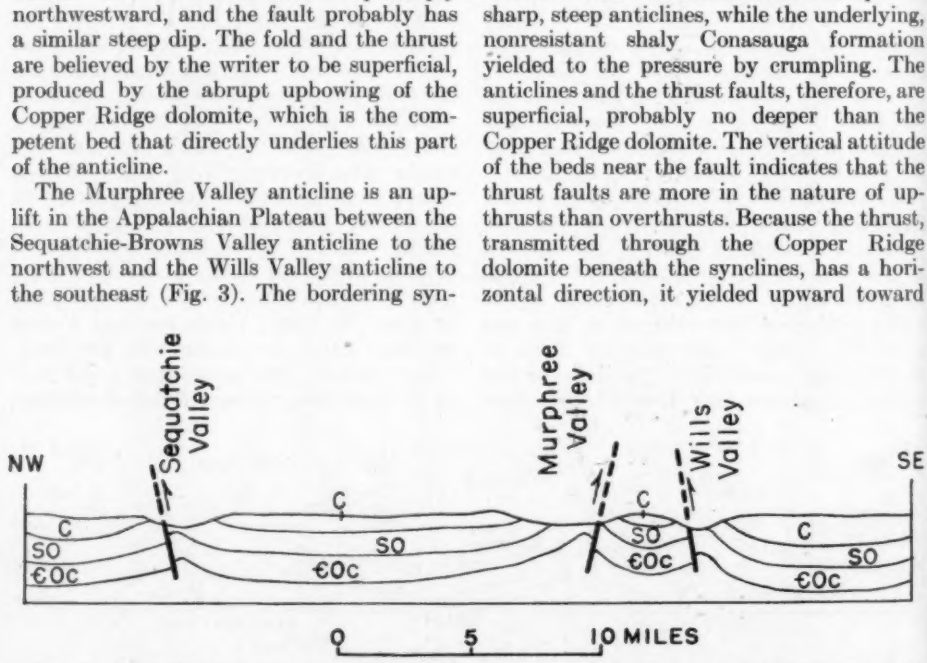

FIG. 3.—Generalized section across Sequatchie Valley, Murphree Valley, and Wills Valley anticlines, Alabama, showing the thrust-bearing bed (€Oc) beneath the broad synclines.

the surface and the upbowing of the anticlines was practically vertical; slight variation in direction of pressure might determine which limb of the anticline would be steeper. The dip of the rocks on the southeast side of the Murphree Valley may have been steeper because the Copper Ridge dolomite beneath the syncline to the southeast may have been lower than that in the syncline to the northwest, and the thrust therefore may have been transmitted lower on that side, a condition which would have produced an underthrust effect in the anticline and have caused the rocks on the southeast side to be steeper (Fig. 2). Such a condition may have been augmented by the close proximity (4 miles) of the southwest plunging end of the Wills Valley anticline, which is unbroken by a thrust fault at this end, and the Copper Ridge dolomite may have descended deeper in the intervening syncline.

There is no evidence for the suggestion by J. L. Rich (1934, p. 1595) that the Sequatchie anticline may be similar to the Pine Mountain thrust. Rodgers (1950, p. 679) has shown that the Sequatchie anticline does not pass into tear faults at its northeast and southwest ends, as does the Pine Mountain thrust, but he supports Rich's analogy of these thrusts by suggesting (his fig. 3, p. 678) their connection by deep-lying faults beneath the intervening flat-lying Carboniferous basins. These connecting hypothetical faults are indeed "bizarre" (p. 680), and there is no evidence that such faults exist, particularly the connection with the Murphree Valley fault which has the overthrust from the northwest, whereas the fault emanates from a thrust in the opposite direction—from the southeast. The structure at Post Oak Springs and Rhea Springs, Kingston quadrangle, may be either younger beds in a window, as is suggested by Rodgers, or they may be explained, as they were by Hayes (1894) with other similar occurrences in the area, as sharply folded and faulted beds of these younger strata. Therefore, they may possibly be windows in the Pine Mountain overthrust like those reported by Miller in Virginia (1947, 1950). These and other suggestions must be considered in the explanation of these structures, and their solution will depend on the results of future more detailed work.

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PALEONTOLOGY.—*The arms of* Haerteocrinus.

HARRELL L. STRIMPLE, Bartlesville, Okla. (Communicated by Alfred R. Loeblich, Jr.)

Over a period of several years the author has acquired three well-preserved specimens of the genus *Haerteocrinus* from the Wann formation exposure located just west of the city limits of Bartlesville, Okla. Description is given below.

Haerteocrinus turbinatus, n. sp.

Figs. 1–7

The dorsal cup expands evenly from the proximal columnal to its upper extremity. Infrabasals (IBB) are five upflared plates, readily visible in side view of the cup. Basals (BB) are five, with height and width approximately equal. Radials (RR) are five, pentagonal, with width normally almost twice the length. The uppermost portion of the cup has a scalloped appearance when viewed from above or below due to the impressions between RR along the adsutural areas. This development restricts the width of the articulating facets.

There are three plates in the posterior inter-

radius, which area is not depressed. Radianal (RA) is obliquely placed, contacting r. post. R to the right below, the right shoulder of post. B to the left below, anal plate (X) to the left above, and right anal plate (RX) directly above. Anal X is in full contact with post. B. RX is the smaller of the three and its upper surface forms a common plane with X. The upper surfaces of both RX and X have muscular fossae somewhat comparable to those of the RR. There is an outer ligament pit bordered by a transverse ridge. The outer marginal ridge and transverse ridge possess denticles, and other crenulations are found behind the muscle scar. Intermuscular notches are narrow but well defined, that of anal X being to the left of center, and of RX to the right of center.

Articulating facets of RR slope mildly outward and do not fill the upper faces of RR. There is a small outer rim in front of the sharp outer ligamental furrow. The transverse ridge is pronounced and is marked with denticles. Lateral furrows are well defined and intermuscular notch is rather large. Muscle scars are shallow.

First primibrachials (PBrBr) in all rays are low, axillary plates, having triangular outlines. A second branching takes place with the fourth or fifth secundibrachials (SBrBr) in all rays. Thereafter, the outer rays remain unbranched and taper slowly to their termination. In the inner rays, the arms widen slowly as a third division is approached, with or about the sixth tertibrachials (TBrBr), and subsequently formed outer rays remain unbranched to their termination. There is another gradual widening of the inner rays as another bifurcation is approached, with or about the sixth quatrobrachials (QBrBr). The arms are not preserved to their termination in all rays; however, 40 robust, pinnular, elongated, uniserial arms are indicated. The brachials are all rather short and have well-rounded, smooth exteriors.

The column is composed of round, moderately thick segments, which are pierced by a small pentalobate lumen. In the large figured paratype, the proximal columnal is seen to have a mildly pentagonal outline.

The plates of the dorsal cup are rather thick, and their external surfaces have a natural sheen, as if the specimens were polished. At their distal extremities, the IBB have a thickness of 2.0 mm in the large paratype. Sutures are not impressed and there is no granular surface ornamentation.

Both paratypes provided information as to the nature of the tegmen. The smaller paratype discloses the fact that the arms are considerably longer than the tegmen, which only has a length of about 35.5 mm. The tube terminates with a swollen area composed of enlarged, spinose plates. Some plates possess more than one spine, and none of the spines are extended to any great degree. Some pore slits are found in plates of the swollen area. Remnants of the anal tube were found intimately associated with the larger paratype. Normal tube plates have an external sheen comparable to the "polished" appearance of the exterior of the crown. Terminating tube plates are mildly spinose, show evidence of pore slits, and are considerably larger than normal tube plates. It is puzzling to note that normal tube plates show no evidence of pore slits.

Measurements in mm.—As given below. All measurements are linear and are not taken along the curvature of the plates.

	Large figured paratype	*Small figured paratype*	*Holotype*
Height of dorsal cup	19.8	13.1*	14.0*
Width of dorsal cup (maximum)	32.7	21.1*	21.9*
Diameter of proximal columnal	7.6	6.0	6.0
Height of IBB circlet	6.3	3.8*	4.0*
Length of inter IBB suture	4.7	2.0	2.0
Length of r. ant. B	10.0	6.8	7.0
Width of r. ant. B	10.7	7.0	8.1
Length of inter BB suture	5.1	3.1	3.3
Length of r. ant. B	7.9	5.7	6.3
Width of r. ant. R	15.7	8.7	7.1*
Height of l. ant. PBr	6.2	4.0	5.0
Width of l. ant. PBr	13.7	7.8	9.6

* Distorted owing to lateral compression.

Remarks.—There are at this time only three species assigned to *Haerteocrinus*. The genotype species is *Haerteocrinus missouriensis* Moore and Plummer, from the Missourian. In that species the plates of the posterior interradius are more advanced in their arrangement than those of *H. turbinatus*, in that RA has moved to a dominant position in the former, separating anal X from the post. B. From the illustrations given by Moore and Plummer it does not appear that distal faces of anal X and RX form a common plane, as found in *H. turbinatus;* however, they are of subequal height and may well have done so.

H. magnus Moore and Plummer, of the Des Moines series, is based on a single partially preserved dorsal cup, so that close comparison is not possible. From the illustrations given by Moore and Plummer there appear to be slight depres-

sions at the angles of the cup plates, and anal X is in contact with an elongated post. B.

H. washburni (Beede) is most similar to the present species. The principal difference is in the elongated nature of the basal plates and the wider, more robust RX. Although plates of the posterior interradius display considerable variability in some forms, all three specimens of *H.*

FIGS. 1–7.—*Haerteocrinus turbinatus*, n. sp.: 1–2, Holotype from anterior and posterior, × 1.5; 3–6, large paratype from anterior, base and posterior, × 1.2, and portion from summit, × 2.3; 7, paratype from left side, × 1.7.

turbinatus display remarkable consistency in this regard. In *H. turbinatus*, the RX is relatively smaller than found in *H. washburni*.

Close affinity between *H. turbinatus* and *Texacrinus irradiatus* Strimple is indicated in the nature of the arms and many features of the dorsal cups. In both species the anal X and RX form a common upper facet which is similar to the facets of the RR. The main difference lies in the nature of the IBB circlets, which repose at the bottom of a basal concavity in *T. irradiatus* but are upflared and readily visible in side view of the cup in *H. turbinatus*.

Occurrence and horizon.—The hill, locally termed "The Mound," just west of the city limits of Bartlesville, Okla.; crinoid facies of the Wann formation, Ochelata group, Missouri series, Pennsylvanian.

Types.—To be deposited in the U. S. National Museum.

PALEONTOLOGY.—*Designation of the type species of* Pseudochama *(additional note).* DAVID NICOL, U. S. National Museum.

In my recent paper on the genera and subgenera of Chamidae (Nicol, 1952), I stated that the type species of *Pseudochama, Chama cristella* Lamarck, was subsequently designated by Prashad (1932, p. 295). Mr. Druid Wilson, of Johns Hopkins University, has kindly shown me that the same species was designated as the type of *Pseudochama* by Gardner (1926, p. 92).

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ENTOMOLOGY.—*The ant larvae of the myrmicine tribe Crematogastrini.*[1] GEORGE C. WHEELER and JEANETTE WHEELER, University of North Dakota. (Communicated by C. F. W. Muesebeck.)

The late Dr. W. M. Wheeler could often predict by merely looking at a stone or log what kinds of ants would be found under (or in) it. In the summer of 1924 when he and I were collecting on Barro Colorado Island, he selected a certain log as promising. But this time he had made a mistake, for as soon as we opened it he exclaimed, "Just another one of those nasty little Crematogasters!" I was startled—almost shocked—that one of the world's foremost myrmecologists should speak thus disrespectfully of any ant. It was practically blasphemy—myrmecoblasphemy, that is.

To be sure, it was merely an *obiter dictum*. Nevertheless it did seem to express Dr. Wheeler's general attitude toward this genus. In his introduction to the *Ants of the Belgian Congo*[2] he said:

> At my request, Dr. F. Santschi kindly undertook to work up the species of *Crematogaster*, a genus to which he has given much attention. A glance at my catalog of the Ethiopian species will show why I despaired of adequately handling the Congo material of the group. I might have attempted it, if the *Crematogaster* portion of Mr. George Arnold's monograph of the Rhodesian ants had appeared, but the World War had stopped the publication of this important work, so that even in making my catalog I had nothing to rely on except the confused mess in the existing literature. Mr. Arnold nevertheless sent me some valuable comments on several of the species, together with the following remarks on the genus as a whole: "The genus *Crematogaster* is perhaps the most troublesome of all, and for this there are several reasons. First of all, it is a very large genus, so large that authors get lost in the vast number of described forms and of their collections. Secondly, the species of this genus in Africa are exceptionally liable to minute variations in all

[1] The research on which this article is based was aided by a grant-in-aid from the Sigma Xi Research Fund.

[2] Bull. Amer. Mus. Nat. Hist. **45**: 7–8. 1922.

directions even over a very small area. . . ., and even within the limits of the same nest . . . Thirdly, in the separation of species and varieties, too much emphasis has been placed on unreliable characters . . . Lastly, a good deal of confusion is due to sheer carelessness and contempt for exact methods."

This same distaste for *Crematogaster* seems to be rather general among myrmecologists. I have certainly shared it when collecting in Oklahoma, Texas, and Central America, where it is one of the commonest genera.[3] And now the study of the larvae has strengthened my distaste.—G. C. WHEELER.

* * *

Tribe CREMATOGASTRINI Forel

The tribe Crematogastrini comprises a single genus. But what a genus! Emery in his *Genera insectorum* listed 274 species, which make it the fourth largest genus of ants. These species are grouped in 11 subgenera; many of them have numerous subspecies and varieties. But all this is merely small-scale diversity. The genus as a whole —both adults and larvae—is remarkably homogeneous and easily recognized at a glance.

But as soon as one steps inside the genus, all is confusion. It is not possible to characterize larval subgenera (at least with the material at hand), for the differences within a subgenus may exceed those between subgenera. In fact, the differences within a single nest may surpass those between subgenera.

This brings us to the most remarkable discovery in this study: the apparent dimorphism of the larvae of *Crematogaster lineolata subopaca*, which is fully described below and illustrated on the plates. It is certainly tempting to speculate on the cause of this phenomenon—dimorphic queens, social parasitism, genetic segregation after hybridization, etc. But we resist temptation and simply state that we do not have enough facts even for a tentative hypothesis.

Genus **Crematogaster** Lund

Plump, chunky, and straight; practically immobile; subellipsoidal or subcylindrical; ends rounded; anterior end formed by the dorsum of the prothorax; head flattened against the ventral surface near the anterior end; no neck. Anus posteroventral. Leg vestiges present. Segmentation indistinct. Spiracles unequal in diameter, the first (i.e., mesothoracic) much the largest, the remainder small and diminishing progressively toward the posterior end. Body hairs sparse; uncinate hairs short to moderately long; other hairs minute to short. Seven types of body hairs occur in the genus: (1) simple; (2) with the tips bifid; (3) with the tips multifid; (4) with the tips frayed; (5) with the apical portion denticulate; (6) with the apical portion broad, flat and denticulate; (7) uncinate hairs, with a heavy, nearly straight shaft and a stout anchor-like tip, restricted to the dorsal surface of abdominal somites I–V or I–VI and arranged in transverse rows of 3–8 hairs, one row on each somite. A species may have two, three or four of these types; the majority have three types. Head with the dorsal and dorsolateral regions thin and depressed; mouth parts small; from each gena a sclerotized band (which is a continuation of the internal skeleton) passes out of the head and enters the prothorax. Antennae small or minute; each with 1–4 (usually 2 or 3) sensilla. Head hairs sparse; minute to short; usually shorter than body hairs; mostly simple. Labrum very small and short; breadth 3-4X length; subtrapezoidal or subrectangular; ventral border concave; anterior surface with 1–4 isolated and two agglomerated senilla on each half; posterior surface with 4–8 sensilla, but without spinules. Mandibles very small [ratio of head width to mandible length = 4.3 to 9.4 (average 6.7)]; short [ratio of mandible length to width at base = 1.3 to 2 (average 1.5)]; base inflated and feebly sclerotized; apex moderately sclerotized, narrowed to a sharp point and slightly curved medially; no medial teeth; no spinules. Maxillae small; apex paraboloidal and directed medially; without spinules; palp represented by a cluster of three or four agglomerated sensilla; galea represented by two agglomerated sensilla. Labium small; without spinules; palp represented by a cluster of four agglomerated sensilla; a minute sensillum between each palp and the opening of the sericteries; the latter a short transverse slit. Palps and galea never paxilliform. No spinules seen on the hypopharynx.

To most of the characters in the foregoing definition there are exceptions. Nevertheless the

[3] In North Dakota the picture is entirely different: *Crematogaster* is rare in the southern half of the State and apparently absent in the northern half.

larvae of *Crematogaster*—like their adults—constitute a well defined and homogeneous group. They are readily distinguished from the larvae of other tribes by the shape of the body; the position of the head; the variation in the size of the spiracles of different somites; the paucity and small size of the hairs (except the few uncinate hairs); the depressed dorsal and dorsolateral regions of the head; the sclerotized band emerging from each gena; the reduction of the mouthparts; the reduction of the palps and galea to clusters of sensilla; the lack of spinules on the mouth parts. None of these characters would alone serve to differentiate the larvae from those of all other genera, but as a group they define the genus and tribe very well.

The larvae of *Crematogaster* closely resemble the larvae of the subfamily Dolichoderinae in all the above characters, but they may be differentiated as follows: In the latter the first abdominal spiracle is the largest; uncinate hairs lacking (or, when present, with only one hook); dorsal and dorsolateral regions of the head not depressed (except in *Dolichoderus*); no sclerotized band emerging from each gena; spinules present on the mouth parts. The dolichoderine *Azteca* is the genus most easily confused with *Crematogaster*; in fact, it can be distinguished only by the presence of spinules on its mouth parts and by the shape of its uncinate hairs, which are spirally coiled and have only one hook.

Also like the Dolichoderinae, the larvae of the Crematogastrini are a highly specialized group and both groups are specialized mostly through reductions and losses rather than by elaborations: body length is reduced; mobility is almost lost; hairs are few, short and simple (except the few uncinate hairs); mouth parts are reduced—almost vestigial; the trophorhinium is lacking; palps and galea are merely clusters of sensilla.

In this article we describe the larvae of 11 species representing four subgenera. References from the literature are cited for additional species, making the total considered 16 species in five subgenera.

Athias-Henriot (1947, p. 253) characterized the larvae of this genus as "évolués, simples, . . . reliant [les Myrmicinés] aux [Dolichodérinés]."

Bristowe, 1932: "The nests of a species of *Crematogaster* (called Mott dam) are collected on account of their grubs which are eaten in a curry in the Hua Hin district."

Gantes, 1949: "Larves immobiles" (p. 84). "La croissance est forte au stade IV et elle est ralentie au stade V, mais ce ralentissement est très faible" (p. 85). "Chez *Crematogaster* les poils à double crochet sont plus longs au stade IV qu'au stade V. Donc, l'accrochage mutuel, important pour le transport des larves par les ♀, est surtout possible aux stades jeunes. II à IV" (p. 87). "Larves très évoluées comme *Crematogaster* . . . Ces larves sont immobiles, ont des mandibules minuscules" (p. 88).

Stärcke, 1948, p. 28: "Body still more swollen, of a short oval or nearly globose shape, with a small head projecting on the ventral side."

Crematogaster (Acrocoelia) lineolata Say
Fig. 1 (*1–4*)

Plump, chunky, and turgid; straight and subellipsoidal; diameter greatest at abdominal somite II; ends round-pointed; anterior end formed from the dorsal portion of the prothorax. Head flattened against the ventral surface near the anterior end; no neck. Anus posteroventral. Leg, wing, and gonopod vestiges present. Approximately a third of the larvae have one, two, or three abdominal leg vestiges (?) on somites I–III, which are larger and more conspicuous than those on the thorax. Segmentation indistinct. Spiracles unequal in size; the first much the largest, the remainder diminishing gradually. Integument of the posterior somites with a few spinules which are either isolated or in short transverse rows. In addition, approximately half the larvae have on each lateral surface of most somites a dorsoventrally elongate patch of minute, stout spinules. Body hairs sparse, somewhat more abundant on the prothorax. Of two types: (1) simple, slightly curved, 0.009–0.036 mm, the most numerous type; (2) a row of four to six nearly straight 2-hooked uncinate hairs on the dorsal surface of each abdominal somite I–VI, about 0.14 mm long. Head moderately large; subtrapezoidal or subcordate in anterior view; narrowed ventrally; about as long as broad; extensive dorsolateral portions thin and depressed; mouth parts small. Inside the head just above the level of the mouth parts there is a slender transverse sclerotic bar; at each end of this bar a large sclerotized lobe is exposed on the surface and extends outward into the prothorax; a slender branch of the lobe extends upward inside the gena and at its end protrudes laterally for a short distance. Antennae

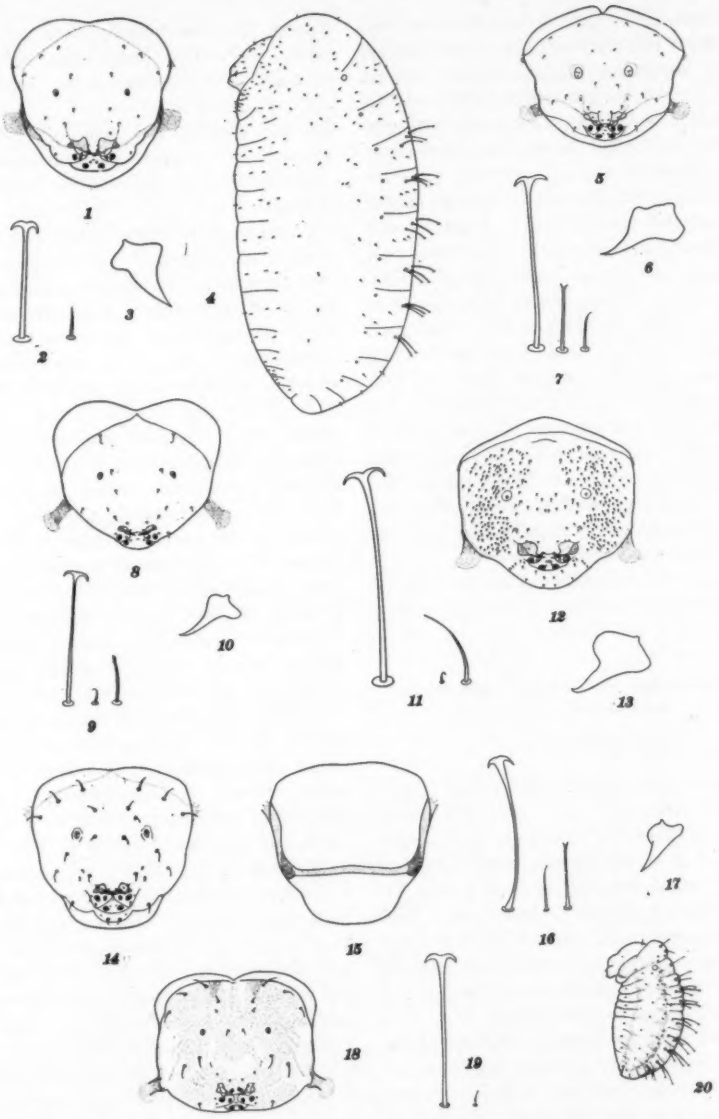

FIG. 1.—*Crematogaster* (*Acrocoelia*) *lineolata* Say: *1*, Head in anterior view, × 76; *2*, two body hairs, × 185; *3*, right mandible in anterior view, × 216; *4*, larva in side view, × 32. *5–7*, *C.* (*A.*) *laeviuscula* Mayr: *5*, Head in anterior view, × 60; *6*, left mandible in anterior view, × 216; *7*, three body hairs, × 185. *8–10*, *C.* (*A.*) *menileki proserpina* Santschi: *8*, Head in anterior view, × 86; *9*, three body hairs, × 185; *10*, left mandible in anterior view, × 216. *11–13*, *C.* (*A.*) *auberti sordida* Forel: *11*, Three body hairs, × 185; *12*, head in anterior view, × 76; *13*, left mandible in anterior view, × 216. *14–20*, *C.* (*A.*) *lineolata subopaca* Emery: *14*, Head of type A in anterior view, × 76; *15*, head of type A in posterior view to show chitinized bar, × 76; *16*, three body hairs of type A, × 185; *17*, left mandible of type A in anterior view, × 216; *18*, head of type B in anterior view, × 76; *19*, two body hairs of type B, × 185; *20*, very young larva in side view, × 32.

minute, each with three (rarely two or one) sensilla. Head hairs sparse, very short (0.009–0.035 mm), simple and slightly curved. Labrum very small; short (length one-third the width); subtrapezoidal in anterior view; narrowed ventrally; ventral border feebly to moderately concave; anterior surface of each half with two or three isolated sensilla and two agglomerated sensilla near the ventral border; posterior surface with four scattered sensilla. Mandibles very small; apical two-thirds rather stout, sharp-pointed, slightly curved medially, moderately sclerotized; basal one-third feebly sclerotized and inflated. Maxillae small; apex paraboloidal and directed medially; palp a cluster of four sensilla; galea two agglomerated sensilla. Labium small; palp a cluster of four sensilla; a minute sensillum between each palp and opening of sericteries; the latter a short transverse slit.

QUEEN: Similar to worker, except that the body is relatively more voluminous and the head and hairs relatively smaller.

(Material studied: Numerous larvae from six nests collected in Michigan, New Hampshire, New Jersey, and New York.)

Crematogaster (Acrocoelia) lineolata subopaca Emery

Figs. 1 (*14–20*), 2

WORKER TYPE A: Plump, chunky, and turgid; straight and subcylindrical, with the dorsal and ventral profiles nearly straight and moderately long, while in ventral view there is a slight constriction at abdominal somites I and II; ends round-pointed, the posterior end more narrowly so; anterior end formed from the dorsal portion of the prothorax. Head thin and flattened against the ventral surface near the anterior end; no neck. Anus posteroventral. Leg, wing and gonopod vestiges present; abdominal leg vestiges (?) very rarely present. Segmentation indistinct. Spiracles unequal in size, the first much the largest, the remainder diminishing gradually. Integument of abdominal somites VI–X spinulose, the spinules minute and isolated or in short transverse rows. Body hairs sparse, somewhat more abundant on the prothorax. Of three types: (1) simple, very short (about 0.027 mm on the ventral surface to 0.045 mm on the dorsal surface), the most abundant type; (2) with the tip bifid, about 0.045 mm long, a few on the dorsal surface of each somite; (3) nearly straight 2-hooked uncinate hairs, moderately long (about 0.14 mm), six to eight in a row across the dorsal surface of each abdominal somite I–VI. Head subtrapezoidal in anterior view; narrowed below; slightly broader than long; dorsolateral regions thin and depressed; mouth parts small. Inside the head, just above the level of the mouth parts, there is a slender transverse sclerotic bar; each end of the bar turns upward and continues inside the gena; it finally becomes external near the dorsal corner of the cranium and extends laterally a short distance onto the prothorax. Antennae minute, each with three (rarely two) minute sensilla. Head hairs sparse, short (0.009–0.035 mm), simple and slightly curved. Labrum very small, short (length one-fourth the width), subtrapezoidal, narrowed ventrally; ventral border feebly concave; anterior surface of each half with four isolated sensilla and with two agglomerated sensilla near the ventral border; posterior surface with three sensilla on each half. Mandibles very small; apical two-thirds slender, sharp-pointed, slightly curved medially, moderately sclerotized; basal third feebly sclerotized and widely inflated. Maxillae small; apex paraboloidal and directed medially; palp represented by a cluster of four sensilla; galea represented by a cluster of two agglomerated sensilla. Labium small; palp represented by a cluster of four sensilla; a minute sensillum between each palp and opening of sericteries; the latter a short transverse slit between the tips of the maxillae.

WORKER TYPE B: Plump and chunky; straight and subcylindrical; not constricted at the middle; ends round-pointed; anterior end formed from the dorsal portion of the prothorax. Head thin and flattened against the ventral surface near the anterior end; no neck. Anus posteroventral. Leg and wing vestiges present. Abdominal leg vestiges (?) on somites I–III are much larger and more conspicuous than those on the thorax; in alcoholic material they are brown and can be readily seen at a low magnification; typically three pairs are present but the number may vary from zero to six vestiges. Ten differentiated somites. Spiracles unequal in size, the first much the largest, the remainder diminishing gradually. The thoracic somites and the first seven or eight abdominal somites bear each a pair of conspicuous lateral welts; each welt is elongate dorsoventrally and narrow anteroposteriorly; it stains deeply with acid fuchsin and

its surface is rugose.[4] On either side, between these welts and near their ventral ends, there are integumentary structure of unknown nature and function. Integument of posterior somites spinulose, the spinules minute and isolated. Body hairs sparse. Of two types; (1) simple, minute (0.003–0.018 mm) fairly uniformly distributed; (2) nearly straight two-hooked uncinate hairs, moderately long (about 0.1 mm),

[4] These welts should be compared with the lateral projections described by Eidmann and Menozzi. See our Figs. 3 and 4.

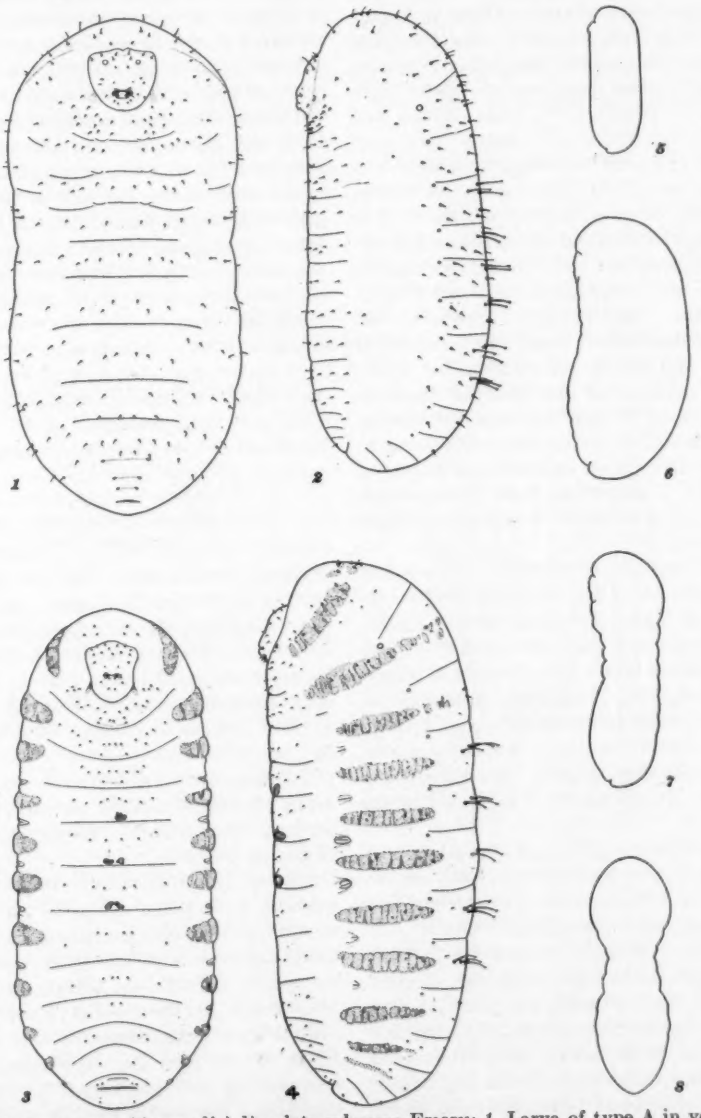

FIG. 2.—*Crematogaster* (*Acrocoelia*) *lineolata subopaca* Emery: *1*, Larva of type A in ventral view, × 32; *2*, larva of type A in side view, × 32; *3*, larva of type B in ventral view, × 32; *4*, larva of type B in side view, × 32; *5*, profile of worker larva, × 8; *6*, profile of queen larva, × 8; *7*, profile of male larva, × 8; *8*, outline of male larva in ventral view, × 8.

three to six in a row across the dorsal surface of each abdominal somite I–V. Head subrectangular in anterior view, slightly broader than long; small dorsolateral areas depressed and thin; integument sclerotized; mouth parts small. At the ventrolateral corner of the head on each side a sclerotized lobose structure emerges and enters the prothorax, where it extends for a short distance; from this a narrow sclerotized bar extends dorsally inside the gena. Antennae minute, with three sensilla each. Head hairs sparse, short (about 0.027 mm), simple and slightly curved; four minute (about 0.003 mm) hairs on the clypeus. Labrum very small, short (length ½x the width), subrectangular, ventral border feebly concave; anterior surface of each half with four isolated and two agglomerated sensilla; posterior surface with four minute sensilla. Mandibles very small; apical two-thirds slender, sharp-pointed, slightly curved medially and moderately sclerotized; basal one-third feebly sclerotized and widely inflated. Maxillae small; the apex paraboloidal and directed medially; palp represented by four agglomerated sensilla; galea represented by two agglomerated sensilla. Labium small; palp an agglomerated cluster of four sensilla; a minute sensillum between each palp and opening of sericteries; the latter a short transverse slit.

YOUNG: Length 0.75–0.95 mm. Plump and chunky; with broad lateral longitudinal welts; dorsal profile C-shaped; ventral profile sinuate; about five somites distinct; the prothorax shows two ventrolateral bosses and a transverse ventral welt. Head on the anterior end. Anus ventral. Body hairs similar to the mature type A larva, but a little shorter. On some young larvae (about 0.95 mm long) there are one to six abdominal leg vestiges (?); presumably these would belong to Type B.

QUEEN: Of two types, A and B; each type is similar to worker type A or B respectively, except that the body is much more voluminous and the head and hairs relatively smaller.

MALE: More elongate; thorax swollen; abdominal somites I–II constricted; rest of abdomen swollen; ends rounded, the posterior more narrowly so; anterior end formed from the dorsal portion of the prothorax. Anus subterminal. Leg and wing vestiges present. The only distinct somites are abdominal I–III, otherwise similar to type A worker larva.

(Material studied: Numerous larvae from five nests collected in Arkansas and Texas.)

Crematogaster (Acrocoelia) aegyptica senegalensis Roger

Gantes, 1949: "♀ 3 mm. Ce sont des larves évoluées, le corps est massif, la tête forme un mamelon à la partie antérieure; les segments sont séparés par de simples lignes blanches: 11 segments. Le corps est couvert de plusieurs sortes de poils, mais on remarque immédiatement sur le dos, des poils à double crochet de 0 mm. 11 de long; ils sont dressés raides sur le dos, on a cinq rangs de six poils, uniquement sur les segments abdominaux. Sur tout le corps on a des poils défensifs de 0 mm. 18 de long. Près de l'anus un poil assez long, fourchu, de 0 mm. 05 et un minuscule à trois branches de 0 mm. 009. La tête est large, couverte de poils simples. Les mandibules sont très petites, 0 mm. 032, fines et aiguës, elles s'insèrent dans la tête par deux branches courtes: elles ressemblent à une lame de couteau. Le palpe proximal et le palpe labial n'ont que quatre sensilles" (p. 83). Pl. V, Fig. IX—larva in side view; hairs enlarged. Growth data are given on page 86.

Crematogaster (Acrocoelia) auberti laestrygon Emery

Athias-Henriot, 1947: "Sa tête mal différenciée (un simple mamelon buccal), son corps presque cylindrique, ses six segments abdominaux. Le corps est recouvert d'une fine pubescence et les segments abdominaux portent dorsalement deux énormes macrochètes fourchus et crochus" (p. 252). Internal anatomy is discussed on pages 260 and 263.

Eidmann (1926, p. 726) referred to the absence of lateral papillae and the presence of uncinate hairs in var. *submaura*. (Mentioned by Eidmann, 1927.)

Gantes, 1949: "Ressemble beaucoup à [*senegalensis*], mais elle a des poils plus variés, les mandibules sont plus longues, 0 mm. 41 et plus fines. Les poils à double crochet en six rangs de quatre à partir du métathorax sont plus longs, 0 mm. 21 et se dressent rigides sans ressort. Vers le bout de l'abdomen ils sont un peu plus courts, 0 mm. 198. De plus sur le thorax nous trouvons des poils identiques, mais plus courts, 0 mm. 115. Sur tout le reste du corps on trouve des poils fourchus de 0 mm. 05 et des poils

simples de 0 mm. 04" (p. 83). Pl. V, Fig. IX P9, five hairs.

Crematogaster (Acrocoelia) auberti sordida Forel
Fig. 1 (*11–13*)

Subcylindrical and relatively slender. Body hairs numerous. Of three types: (1) minute (0.009 mm), simple, with apical half fine and flexible, on the ventral surface; intergrading on the lateral surfaces to (2) longer (0.09 mm), simple and slightly curved, on the dorsal surface; (3) a row of 4–6 nearly straight, moderately long (0.18 mm), 2-hooked uncinate hairs across the dorsal surface of each abdominal somite I–VI. Head hairs minute and exceedingly numerous (about 300). Head subhexagonal in anterior view; dorsal region thin and depressed. Antennae moderately large. Other characters apparently similar to *laeviuscula*. (Material studied: About 50 damaged integuments from Tunis.)

Crematogaster (Acrocoelia) impressa Emery

Eidmann, 1941: "Die Larven zeigen in ihrem Habitus mancherlei Besonderheiten und weichen in dieser Hinsicht von dem üblichen Aussehen der Ameisenlarven nicht unwesentlich ab. Sie sind walzenförmig und gerade gestreckt, also nicht, wie zumeist, ventral eingekrümmt. Das Vorderende ist dadurch ausgezeichnet, dass der Kopf von dem stark entwickelten Prothorax kapuzenförmig überragt wird. Der hintere Teil der Kopfkapsel ist weit in den Prothorax zurückgezogen, so dass die Mundteile senkrecht nach unten, d.h. nach der Ventralseite herausragen. Bei den jüngeren Larven ist die Vorwölbung des Prothorax weniger ausgesprochen als bei den Altlarven. Sämtliche Larven tragen auf der Dorsalseite der ersten sechs Abdominalsegmente grosse ankerförmige Hafthaare, die in je einer Querreihe angeordnet sind. Jede dieser Querreihen besteht aus 4–7, im Durchschnitt 6 Haaren, deren Zahl von vorn nach hinten abnimmt. Bei dem letzten Segment sind meist nur 2–4 vorhanden, bei den jüngeren Larven weniger als bei den älteren . . . Sie dienen dazu, das Aneinanderhaften der Larven zu Paketen zu ermöglichen, wodurch besonders bei Junglarven der Transport durch die Arbeiter erleichtert wird, können aber, wie vermutlich im vorliegenden Fall, auch zum Anhängen der Larven an den rauhen Wandungen der Nestkammern dienen und dadurch zu einer festen Lagerung und gleichmässigen Verteilung im Nest beitragen" (p. 214). Fig. 4 on p. 214 shows a young larva in side view, a mature larva in side view and an uncinate hair enlarged.

Eidmann, 1944, p. 446: "Die Larven sind durch ihre walzenförmige, gestreckte Gestalt und den Besitz von reihenartig angeordneten, ankerförmigen Oncochaeten auf der Dorsalseite der Abdominalsegmente ausgezeichnet."

Crematogaster (Acrocoelia) laeviuscula Mayr
Fig. 1 (*5–7*)

Plump, chunky, and turgid; straight and subellipsoidal; ends narrowly rounded; diameter greatest at abdominal somite II. Head thin and flattened against the ventral surface near the anterior end; no neck. Anus posteroventral. Leg, wing, and gonopod vestiges present. No abdominal leg vestiges found. Segmentation indistinct. Spiracles unequal in size; the first much the largest, the remainder diminishing gradually. Integument of the last few somites spinulose, the spinules minute and isolated or in short transverse rows of two or three. Body hairs sparse, somewhat more abundant on the prothorax. Of three types: (1) simple, slender, slightly curved, 0.01–0.07 mm long, the most numerous type; (2) bifid, about 0.054 mm long, two to six on each of the thoracic somites and on abdominal somites I–VI; (3) nearly straight 2-hooked uncinate hairs, 0.12–0.18 mm long, five or six in a row on the dorsal surface of each abdominal somite I–VI. Head moderately large; subtrapezoidal in anterior view; dorsal outline frequently with a median notch; narrowed below; about as long as broad; extensive dorsolateral regions thin and depressed; mouth parts small. Inside the head just above the level of the mouth parts is a very slender sclerotized transverse bar; at either end it joins a sclerotized lobe, becomes external and extends out for a short distance into the prothorax; a slender branch from this lobe extends dorsally inside the gena and becomes external near the dorsal corner of the cranium. Antennae small, each mounted on a low convexity and bearing three (rarely two) sensilla. Head hairs sparse, short (0.01–0.35 mm), simple and slightly curved. Labrum very small, short (length a little less than one-fourth the width); subtrapezoidal, narrowed ventrally; ventral border feebly to deeply impressed;

anterior surface of each half with three isolated and two agglomerated sensilla; posterior surface with two or three sensilla on each half. Mandibles very small; apical third slender, sharp-pointed, slightly curved medially, moderately sclerotized; basal two-thirds widely inflated and feebly sclerotized. Maxillae small; apex paraboloidal and directed medially; palp a cluster of four sensilla; galea two agglomerated sensilla. Labium small; palp a cluster of four sensilla; a minute sensillum between each palp and opening of sericteries; the latter a short transverse slit. (Material studied: Numerous larvae from two nests collected in Texas).

Crematogaster (Acrocoelia) menileki proserpina Santschi

Fig. 1 (*8–10*)

Body hairs sparse, of three types: (1) Simple, minute (about 0.012 mm), with recurved tip; (2) with frayed tip, about 0.036 mm long, on the dorsal surface only; (3) nearly straight two-hooked uncinate hairs, about 0.11 mm long, about four in a row on the dorsal surface of each abdominal somite I–V. Head hairs minute to very short (0.006–0.018 mm), with the tip recurved. Posterior surface of labrum with two isolated sensilla on each half. Mandibles with the apical two-thirds slender, sharp-pointed, slightly curved medially and moderately sclerotized; basal one-third inflated and feebly sclerotized. In other respects apparently similar to *lineolata*. (Material studied: A single damaged integument from the Belgian Congo.)

Crematogaster (Acrocoelia) rivai luctuosa Menozzi

Fig. 3

Menozzi, 1930: "La larva del primo stadio, o da pochi giorni uscita dall'uovo, ha corpo ovale, poco allungato, molto più assottigliato all'innanzi che all'indietro, col lato dorsale, visto di fianco, convesso e quello ventrale in parte, anteriormente concavo e poi convesso posteriormente. Ha distinti, oltre il capo, 10 segmenti, l'ultimo dei quali piuttosto ristretto all'indietro e terminato con una sorta di lobo più o meno sviluppato. Tutti i segmenti hanno qualche peluzzo di forma semplice, inoltre i segmenti 4–10 sono provvisti al dorso, sulla linea mediana trasversale, di 3 o 4 lunghe setole terminate a doppio uncino. Il capo visto di lato ha la forma di un cono tronco, è fornito di mandibole piccole, strette ed appuntite. Lunghezza mm. 1,7; larghezza massima mm. 0,9. La larva del secondo stadio ha il corpo all'incirca rotondeggiante, fortemente depresso, quasi lenticolare, piano al dorso, mediocremente convesso al ventre, diviso in 12 segmenti oltre il capo. Questo è più largo che lungo, coi lati lobiformi. I segmenti 1–8 dell'addome sono provvisti lateralmente e in continuazione del piano dorsale di lunghe appendici più o meno rettangolari coll'apice ottusamente arrotondato; il 9° segmento (ultimo) è tribolato, cioè ha due appendici laterali alquanto più piccole di quelle dei segmenti precedenti e di forma subtriangolare e termina posteriormente, nella linea mediana, con un lobo codale a forma di cappuccio; inoltre i segmenti addominali 3–7 hanno in più ognuno, al ventre, nella linea mediana longitudinale, un'altra appendice di forma all'incirca eguale a quella dei lati, ma più corta. La funzione di tali appendici, che trovano riscontro in altre conformazioni omologhe ed analoghe di altre larve di formiche, si ritiene che sia quella di facilitare l'uscita per osmosi dei prodotti di escrezione emmessi da parecchie cellule del tessuto adiposo: infatti, ad un esame istologico, si trova che la parte distale delle dette appendici e riempita di un essudato sotto forma di liquido più o meno nettamente granuloso, mentre nella parte prossimale vi è un ammasso di numero variabile di cellule adipose o trofociti, di cui alcune, sparse pel corpo, ma quasi sempre raccolte in vicinanza

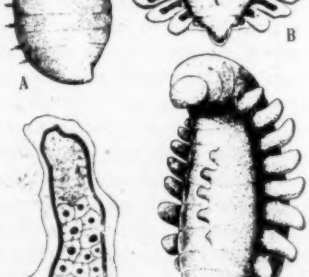

FIG. 3.—*Crematogaster (Acrocoelia) rivai luctuosa* Menozzi: *A*, *B*, and *C*, Larvae of the first, second, and third stadia; *D*, longitudinal section of a lateral projection of a larva of the second stadium. (After Menozzi, 1930.)

dell'entrata dell'appendice, contengono numerosi cristalli di urato. La chetotassi delle larve in questo stadio è su per giù eguale a quella della larva precedentemente descritta e così dicasi anche per le setole uncinate che si trovano sul dorso dei segmenti 4–10. Lunghezza mm. 1,02; larghezza mm. 1,48. Larva matura.—In questo stadio fatte le debite proporzioni, il corpo della larva riprende la forma somigliante alquanto a quella del primo stadio, cioè ovale ma più allungata e ancora più fortemente ristretta in avanti. Sono distinti, oltre il capo, 12 segmenti; il 2° segmento toracico é come i precedenti coi lati arrotondati, i segmenti successivi, eccetto l'ultimo, hanno le appendici che si trovano nella larva del secondo stadio, solo che esse sono ridotte in lunghezza. Lunghezza mm. 2,5; larghezza massima, presa sul 10° segmento e comprese anche le appendici laterali, mm. 1,6." (pp. 100–102). Fig. 3 on p. 101: A, B & C—larvae in the 1st, 2nd and 3rd stadia; D—longitudinal section of a lateral appendage of a second-stadium larva.

Crematogaster (Acrocoelia) scutellaris Olivier
Fig. 4

Berlese, 1902, p. 239: "Il primo grande stigma, perfettamente circolare è sul secondo segmento e tutti gli altri, che sono egualmente circolari, vanno decrescendo in diametro e sono scolpiti ciascuno su ciascuno dei segmenti successivi, cosicchè il primo e l'ultimo segmento del corpo non recano stigmi."

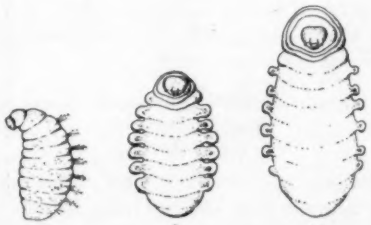

FIG. 4.—*Crematogaster* (*Acrocoelia*) *scutellaris* Olivier: *A*, Young larva in side view; *B* and *C*, older larvae in ventral view. (After Eidmann, 1926.)

Eidmann, 1926: "Wie kommt es, dass die Larven nicht durch ihre Schwere nach unten fallen und sich im unteren Teil der Kammern anhäufen? Sie besitzen, um dies zu verhindern, sehr zwekmässige Anpassungen. Auf der Dorsalseite der mittleren Segmente findet man je eine Querreihe von eigenartigen starken Haaren, während der übrige Larvenkörper nackt ist. Bei starker Vergrösserung sieht man, dass diese Haare an ihrer Spitze höchst merkwürdige Bildungen tragen. Die meisten enden in zwei Klauen, die entweder in einer Ebene liegen und dadurch wie ein Anker aussehen, oder auch nach einer Seite gerichtet sind. Die Haare der mittleren Segmente sind fast alle so gestaltet. Auf den hinteren Segmenten trifft man dagegen ganz seltsam geformte Endigungen der hier meist kürzeren Haare. Zackige, geweihartige und kronenförmige Gebilde sieht man hier in allen möglichen Variationen vertreten, von denen die Abbildung eine Auswahl zeigt, und zwischen ihnen stehen hier und da kurze, starre, borstenförmige Haare. Wie ein Wald von Hellebarden und Enterhaken starren einem diese Gebilde unter dem Mikroskop von dem Rücken einer Larve entgegen. Diese Haare stellen eine ausgezeichnete Haftvorrichtung dar, sowohl zum Anhängen der Larven an die Wände der steilen Kammern als auch zum Zusammenhängen mehrerer Larven zu Bündeln. Selbst an totem Alkoholmaterial kann man die Wirkung noch beobachten, Watteflöckchen oder andere Fremdkörper haften ausserordentlich fest an ihnen und die zusammenhängenden Larven lassen sich nur schwer voneinander trennen. Sämtliche Larvenstadien sind mit diesen Hafthaaren versehen, die älteren Larven tragen jedoch neben diesen Haaren noch höchst merkwürdige Bildungen an ihrem Körper, die den jüngsten Stadien fehlen, und die ihnen ein ganz eigenartiges und ungewohntes Aussehen verleihen. Dies sind zwei Reihen von grossen, knopfartigen Papillen, die auf jeder Körperseite in einer Reihe hintereinander in der Zahl von sechs bis acht sitzen. Jedes Segment mit Ausnahme der ersten und letzten trägt links und rechts je eine solche Ausstülpung. Es scheint als ob die Papillen dem Wachstum ihrer Träger nicht folgen, denn bei älteren Larven sind sie relativ viel kleiner als bei den jüngeren Stadien. Der Zweck der Papillen lässt sich nicht ohne weiteres erkennen, doch nehme ich an, dass auch sie in irgendeiner Beziehung zu der Lebensweise in den hohen Nestkammern stehen. Bei *Cr. submaura*, die in der Erde lebt, fehlen nämlich diese Bildungen und ihre Larven sehen wie jede andere Ameisenlarve aus. Sie haben zwar auch die langen, ankerförmigen Hafthaare, doch ist dies keine Besonderheit, da eine Reihe anderer Ameisenar-

ten (*Pheidole*, *Solenopsis* u. a.) gleichfalls damit versehen ist. Die Papillenreihen der *Scutellaris*-Larven dienen wahrscheinlich auch dazu, das Festhängen und Haften an der Wand der Kammern und untereinander zu gewährleisten, vielleicht enthalten sie auch Drüsen, die ein klebriges Sekret absondern, wie die Rückenpapillen der Larven von *Ponera coarctata*, wenngleich sich diese weder in ihrer Grösse noch in ihrer Anordnung mit den Papillen der *Scutellaris*-Larven vergleichen lassen. Schliesslich wäre noch an eine dritte Möglichkeit zu denken, nämlich, dass es sich um Exsudatorgane handelt, wie sie Wheeler (1923) von verschiedenen Arten beschrieben hat, doch kann darüber wie über die vorhergenannten Möglichkeiten nur die genaue Beobachtung am lebenden Objekt Aufschluss geben" (pp. 724–726). (Mentioned by Eidmann, 1927; 1928, p. 237; 1936, p. 36.) Fig. 10 on p. 725, hairs; fig. 11 on p. 726, a young larva in side view, and two older larvae in ventral view.

Crematogaster (Crematogaster) acuta (Fabricius)
Fig. 5 (*1–5*)

Body straight, elongate-subellipsoidal, and rather slender; both ends rounded, but with the terminal somites directed posteroventrally and forming a low, blunt point; belly paunchy at abdominal somites III and IV. Head applied to the ventral surface near the anterior end; no neck. Anus ventral. Leg, wing and gonopod vestiges present. Segmentation indistinct. Spiracles unequal in size; the first much the largest, the remainder diminishing gradually. Integument of the dorsal surface of the posterior somites spinulose, the spinules isolated and minute. Body hairs moderately abundant, short to moderately long and rather uniformly distributed. Of three types: (1) Simple, short (0.02–0.08 mm), longest on the prothorax, slightly curved, limited to the ventral and ventrolateral surfaces; (2) curved, with multifid tip, 0.054–0.19 mm long, limited to the dorsal and dorsolateral surfaces, the tips directed dorsally or posteriorly, those on the prothorax the longest and most strongly curved; (3) nearly straight two-hooked uncinate hairs, about 0.19 mm long, usually four on each abdominal somite I–VI. Head very small, subhexagonal in anterior view; a fourth broader than long; somewhat narrowed dorsally, ventral outline convex; integument sclerotized; from each ventrolateral corner a heavily sclerotized structure passes into the prothorax; mouth parts small. Antennae minute raised areas, each with three sensilla. Head hairs sparse, simple, slightly curved, moderately long (0.009–0.054 mm), with stout base and flexible tip. Labrum very small, short (length one-fourth the width), subtrapezoidal, narrowed ventrally: ventral border feebly concave; anterior surface with three isolated and two agglomerated sensilla on each half; posterior surface with three isolated sensilla on each half; ventral border with a few spinules. Mandibles very small; apical three-fifths moderately sclerotized, slender, slightly curved medially and tapering to a sharp point; basal two-fifths feebly sclerotized and only slightly inflated. Maxillae small; apex paraboloidal and directed medially; palp represented by three agglomerated sensilla; galea represented by two agglomerated sensilla. Labium small; palp represented by three agglomerated sensilla; a minute sensillum between each palp and opening of sericteries; the latter a short transverse slit. (Material studied: Numerous larvae from Panama Canal Zone.)

YOUNG: Length about 1.4 mm. Similar to the adult except as follows: Posterior end of abdomen somewhat attenuated and turned ventrally at right angles; ventral profile otherwise straight. Anus subterminal. Body hairs relatively longer and seemingly more abundant. Head relatively larger.

G. C. and E. H. Wheeler have recorded (1924, p. 54) 26 larvae of this species which were parasitized by an undetermined eulophid. Fig. 2 on page 55 is a photograph of two eulophid pupae inside one of the ant larvae.

Crematogaster (Orthocrema) limata dextella Santschi
Fig. 5 (*9–14*)

Straight, subcylindrical, and rather stout; ends rounded; head and prothorax slightly bent ventrally; head anteroventral; no neck. Anus posteroventral. Leg, wing, and gonopod vestiges present. Segmentation indistinct. Spiracles unequal in size, the first the largest, the tenth the smallest. Body hairs sparse, somewhat more abundant on the prothorax. Of three types: (1) A very few simple, minute (0.018–0.054 mm), flexible hairs on the ventral surface of the thorax; (2) hairs with denticulate tip, short (0.036–0.081 mm), generally distributed; (3) nearly straight two-hooked uncinate hairs, mod-

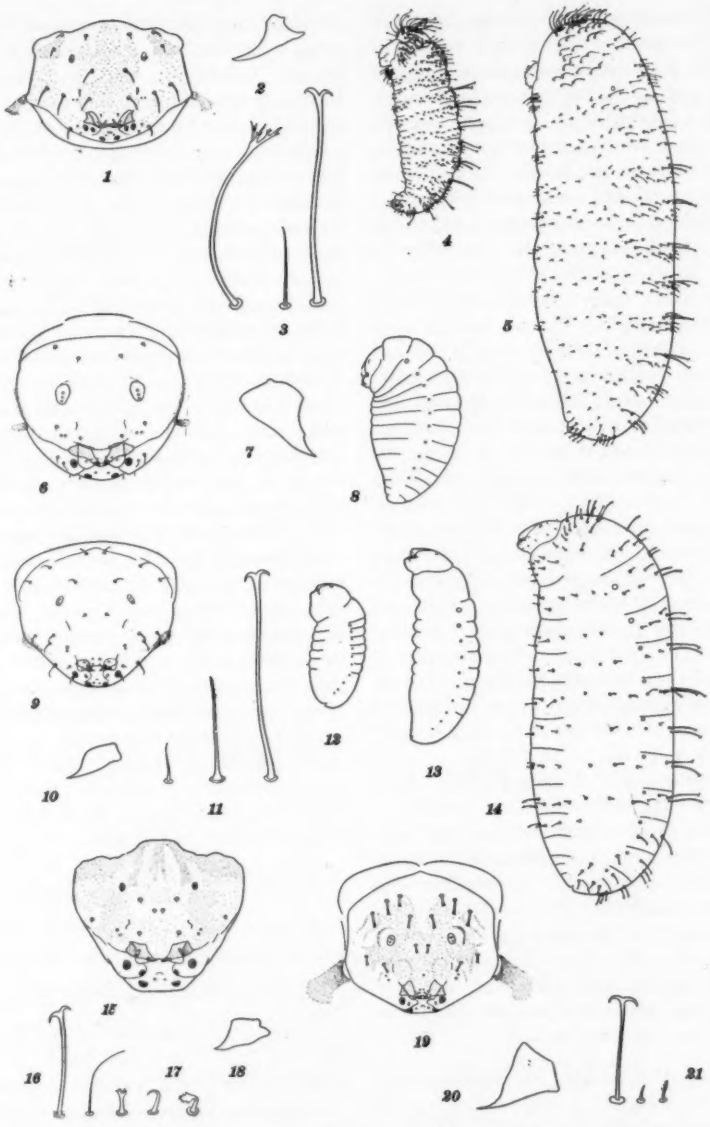

FIG. 5.—*1–5*, *Crematogaster* (*Crematogaster*) *acuta* (Fabricius): *1*, Head in anterior view, × 86; *2*, left mandible in anterior view, × 216; *3*, three body hairs, × 185; *4*, young larva in side view, × 20; *5*, mature larva in side view, × 20. *6–8*, *C.* (*Orthocrema*) *minutissima missouriensis* Emery: *6*, Head in anterior, × 95; *7*, right mandible in anterior view, × 216; *8*, young larva in side view (hairs omitted), × 33. *9–14*, *C.* (*O.*) *limata dextella* Santschi: *9*, Head in anterior view, × 95; *10*, left mandible in anterior view, × 216; *11*, three body hairs, × 185; *12*, very young larva in side view (hairs omitted), × 32; *13*, young larva in side view (hairs omitted), × 32; *14*, mature larva in side view, × 32. *15–17*, *C.* (*O.*) *brevispinosa* Mayr: *15*, Head in anterior view, × 167; *16*, three types of body hairs, × 185; *17*, two views of the fourth type of body hair, × 185; *18*, left mandible in anterior view, × 216. *19–21*, *C.* (*Physocrema*) *deformis* F. Smith: *19*, Head in anterior view, × 76; *20*, left mandible in anterior view, × 216; *21*, three body hairs, × 185.

erately long (about 0.18 mm), about four in a row across the dorsal surface of each abdominal somite I–V. Head subhexagonal in anterior view, narrowed ventrally; dorsal and ventral outlines convex; breadth about equal to length; dorsal and dorsolateral areas thin and depressed; mouth parts very small. Inside the head, just above the level of the mouth parts, there is a slender transverse sclerotic bar; each end of the bar turns upward and comes to the surface in the gena. Antennae small, with two sensilla each. Head hairs sparse, short (about 0.018 mm), simple and slightly curved. Labrum very small, short (breath 3½ times length), bilobed due to a deep concave incision of the ventral border; anterior surface with four isolated and two agglomerated sensilla on each half; posterior surface with two isolated sensilla on each half; ventral border with a few spinules. Mandibles very small, moderately sclerotized, with a moderately wide base tapering to a sharp point, which is slightly curved medially. Maxillae small; apex paraboloidal and directed medially; palp represented by three agglomerated sensilla; galea represented by two agglomerated sensilla. Labium small; palp represented by three agglomerated sensilla; a minute sensillum between each palp and opening of sericteries; the latter a short transverse slit. (Material studied: Numerous larvae from Panama Canal Zone.)

JUST-HATCHED LARVA: Length 0.6 mm. Head on the anterior end; relatively large; apparently without hairs. Body almost hairless; the uncinate hairs of the adult are represented by small tubercles, each surrounded by its alveolus and articular membrane.

YOUNG LARVA: Length about 1.0 mm. Similar to the mature larva but the head relatively larger and on the anterior end; body hairs relatively longer and seemingly more abundant. Segmentation distinct on the anterior half.

Crematogaster (Orthocrema) brevispinosa Mayr
Fig. 5 (*15–18*)

SEXUAL FORM: Plump, chunky, and turgid; subovoidal, narrowed anteriorly; head ventral, near the anterior end. Anus posteroventral. Spiracles unequal in size; the first much the largest, the rest approximately equal. Integument of the posterior abdominal somites spinulose. Body hairs sparse, of four types: (1) Simple and very slender, a few on the lateral and dorsal surfaces, 0.018–0.07 mm long; (2) with the apex broad, flat and denticulate, minute (about 0.018 mm), a few on the ventral surface of the mesothorax, metathorax and abdominal somites I–IX; (3) minute (about 0.018 mm), stout, with frayed tip, on the dorsal surface of the prothorax, mesothorax and abdominal somites IX and X, and on the ventral surface of the prothorax and abdominal somite X; (4) nearly straight two-hooked uncinate hairs, short (about 0.087 mm), three or four in a row across the dorsal surface of each abdominal somite I–V. Head subtrapezoidal in anterior view (but with a median dorsal truncate production), narrowed below; about as long as broad; integument somewhat sclerotized. Antennae minute, with three or four sensilla. Head hairs very few minute (about 0.006 mm) and simple. Labrum very small, short (length one-third the width), bilobed due to the concavity of the ventral border; anterior surface with two sensilla on each half; posterior surface with eight scattered sensilla; ventral border with a few spinules. Mandibles small; moderately sclerotized; basal two-thirds slightly inflated; apical one-third slightly curved medially and tapering rapidly to a sharp point. Maxillae small; apex paraboloidal and directed medially; palp represented by four agglomerated sensilla; galea represented by two agglomerated sensilla. Labium small; palp represented by four agglomerated sensilla; a minute sensillum between each palp and opening of sericteries; the latter a short transverse slit. (Material studied: Several larvae from Panama Canal Zone.)

Crematogaster (Orthocrema) brevispinosa tumulifera Forel

Similar to *brevispinosa s. str.* (Material studied: Several sexual larvae from Panama).

Crematogaster (Orthocrema) dispar Forel

Wheeler (1933, p. 89) stated that the queen larvae of a variety of this species "were nearly spherical and resembled pearls."

Crematogaster (Orthocrema) minutissima missouriensis Emery
Fig. 5 (*6–8*)

Leg and gonopod vestiges present. Spiracles unequal in size, the first much the largest, the rest diminishing gradually. Integument of the dorsal surface of the posterior somites sparsely spinulose, the spinules isolated and rather coarse. Head subcircular in anterior view, with the dorsal region thin and depressed. A slender sclero-

tized bar extends, just inside the gena, from the mandible to the level of the antennae; at its middle a stouter branch passes out and enters the prothorax. Antennae moderately large and drumlin-shaped, with three sensilla each. Labrum small, width 2.7 times the length, bilobed owing to the concavity of the ventral border; anterior surface of each half with four or five isolated and two agglomerated sensilla; posterior surface with four isolated sensilla on each half. Mandibles small, moderately sclerotized, subtriangular, with the apex slightly curved medially; medial border bearing a low, blunt tooth. Maxillae small; apex paraboloidal; palp a low knob bearing four or five sensilla; galea represented by two agglomerated sensilla. Labium small; palp a low knob bearing four sensilla; a minute sensillum between each palp and opening of sericteries; the latter a short transverse slit.

YOUNG LARVA: Length 0.77 mm. Plump and chunky, dorsal profile C-shaped, ventral profile sinuous; head ventral, near the anterior end; posterior end round-pointed. Anus ventral. Segmentation distinct on the anterior half; indistinct posteriorly. Other characters apparently as in the mature larva. (Material studied: One mature larva, one semipupa and a dozen young—all damaged—from Oklahoma.)

Crematogaster (Orthocrema) quadriformis roveretoi Forel

Eidmann, 1936, p. 42: "Die Larven sind spärlich behaart und zeigen im übrigen keine bemerkenswerten Besonderheiten."

Crematogaster (Physocrema) deformis F. Smith
Fig. 5 (*19-21*)

Plump, chunky, and turgid; straight and subellipsoidal; head flattened against the ventral surface near the anterior end. Anus ventral. Leg and gonopod vestiges present. Segmentation indistinct. Spiracles unequal in size, the first much the largest, the rest diminishing gradually. At the posterior border of each thoracic somite in the ventrolateral portion of the intersomitic groove is an integumentary structure that looks like a series of transverse folds or ridges; also in the intersomitic grooves between the thoracic and between the anterior abdominal somites are dark staining (with acid fuchsin) transverse bands on the dorsal and ventral surfaces. Body hairs exceedingly sparse, most abundant on the ventral surface of the prothorax. Of three types: (1) Simple, minute (0.009–0.018 mm); (2) stout, denticulate or with frayed tip, minute (about 0.018 mm), on the ventral surface; (3) nearly straight two-hooked uncinate hairs, about 0.09 mm long, about four in a row on the dorsal surface of each abdominal somite I-V. Head subhexagonal in anterior view; integument sclerotized; from each ventrolateral corner of the head a large sclerotized structure passes out and enters the prothorax; mouth parts small. Antennae small, with three sensilla each. Head hairs sparse and short (0.018–0.036 mm), stout, with the tip frayed. Labrum very small, short (width 3½ times the length), bilobed due to a concavity of the ventral border; each half of the anterior surface with three isolated and two agglomerated sensilla; posterior surface with one sensillum on each half. Mandibles small, subtriangular; base broad; tapering to a long slender sharp point, which is curved medially. Maxillae small, apex paraboloidal and directed medially; palp a slightly raised cluster of four agglomerated sensilla; galea represented by two agglomerated sensilla. Labium small; palp a slightly raised cluster of four agglomerated sensilla; a minute sensillum between each palp and opening of sericteries; the latter a short transverse slit. (Material studied: Seven damaged integuments from Java.)

Crematogaster (Sphaerocrema) striatula Emery

Eidmann, 1944, p. 448: "Eben geschlüpfte Eilarven . . . fallen durch ihre gedrungene, kaum gekrümmte Gestalt auf, die Rückseite der Abdominalsegmente ist mit Reihen grosser ankerförmiger Oncochäten besetzt."

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ZOOLOGY.—*Notes on the history and distribution of the reptiles.* AUSTIN H. CLARK, U. S. National Museum.

Reptiles differ from mammals and birds in being cold blooded. They agree with birds in having a relatively dry skin and in being highly dependent on sunlight. More dependent on sunlight than birds, nearly all live in sunny regions, especially in more or less arid, though not excessively arid, regions. Nearly all reptiles lay eggs like birds, but the young emerge from the eggs in the adult form and are not tended or fed by the parents. Nearly all modern reptiles are carnivorous, largely insect-feeders, like most birds, at least when young. Except for being cold blooded, the reptiles in the broader aspects of their ecology are more similar to the birds than they are to any other vertebrates. Morphologically they have been united with the birds under the inclusive term Sauropsida. But some reptiles are viviparous and some are wholly aquatic, as the sea snakes. Some have horny beaks like birds, others uniform or diversified teeth. In the past a number had the power of flight, their wings being essentially like those of the mammalian bats, not like those of birds.

Whereas since the Eocene the mammals and birds have undergone continuous and great diversification with adaptations for the constantly changing conditions and are today the dominant terrestrial vertebrates, the history of the reptiles has been quite different. In the Mesozoic the reptiles had reached a high degree of development and specialization and were highly diversified. There were, among others, gigantic, chiefly herbivorous, dinosaurs, great marine reptiles of various kinds, and several types of flying reptiles, together with the more familiar crocodiles, turtles, and snakes. The development of the reptiles reached a culmination in the Cretaceous, but toward the end of that period most of them disappeared. Up to the end of the Cretaceous there were 19 orders of reptiles, but since the earliest Tertiary, when there were a very few reminders of the exceedingly rich Mesozoic fauna, only 4 of these have persisted, the Rhynchocephalia, represented only by *Sphenodon* or *Hatteria*, the tuatara of New Zealand; the crocodiles, confined to tropical and subtropical regions; the turtles; and the Squamata, including the lizards and snakes.

The world-wide and practically simultaneous disappearance of most of the reptiles, including all the giant terrestrial herbivores and carnivores, the flying pterodactyls, and the large ichthyosaurs, plesiosaurs, and mososaurs, was followed by the evolution and development from mammalian stock of a great variety of types occupying the former habitats of all the terrestrial reptiles, with the cetaceans replacing the marine types. Presumably the place of the flying reptiles was taken by certain birds.

Any satisfactory explanation of the sudden disappearance of the dominant reptiles and their rapid replacement by mammals must be applicable equally to all the continents and to all the oceans as well. In view of the dependence of practically all modern reptiles, especially those with heavy skeletons or dermal scutes such as the hard shelled turtles and the crocodilians, on

abundant sunlight, and the independence of sunlight characteristic of the largely nocturnal mammals, it would seem that a radical change in the amount or character of the sun's radiations reaching the earth may well have been the chief factor in the disappearance of the reptiles which prepared the way for the domination of the mammals.

During the Cretaceous there was extensive inundation of the land areas by the sea, the continents were much isolated, and the climate presumably was warm and uniform. At the end of the Cretaceous there seems to have been a great upheaval of the land in both the northern and southern hemispheres. This was accompanied by local and intermittent volcanic activity throughout the Eocene in the Rocky Mountain region, Central America, the West Indies, and southern Europe. Any marked increase in the land areas would mean a corresponding increase in dust in the atmosphere, inorganic dust from arid areas and pollen and other organic dust from heavily vegetated regions. Volcanic activity would also produce a large amount of atmospheric dust.

Of interest in regard to the latter is the information on the eruption of Krakatoa, between Sumatra and Java, on May 26–28, 1883. In this eruption the height of the ejected column of stones, ashes, and dust was estimated to have reached 17 miles or more. The finer particles were diffused over a large part of the earth and were carried over North and South America, Europe, Asia, South Africa, and Australia. In the Old World they spread from Scandinavia to the Cape of Good Hope. And this is the record of only a single isolated eruption.

With increase in land areas and intermittent volcanic eruptions the illumination of the surface of the earth would be considerably altered. Whereas the extensive inundation of the land areas during the Cretaceous would presumably clear the atmosphere, giving rise to conditions especially favorable to reptiles, increase in land areas, especially in connection with volcanic activity, would make conditions unfavorable for reptiles while at the same time permitting the rapid increase and diversification of mammals.

In their present distribution the land reptiles fall into two main groups. The strictly terrestrial forms, such as the lizards and most snakes, follow largely the distributional pattern of the mammals except that they do not range so far north or south and, possibly because of their greater age, there are among them more striking cases of discontinuous distribution resulting from extirpation over a large portion of the original range. In the mammals examples of discontinuous distribution are the camels, originally North American but now represented only by two wild species in South America, two domesticated species in South America, and two domesticated species in Asia one of which has been introduced into Africa; the tapirs once widespread but now restricted to tropical America and the Malay Peninsula, Sumatra, and Borneo; and the fresh-water dolphins of South America, India, and China; but the last may have been originally marine.

In the Pleistocene many mammals spread from Asia into North America, and from North America into Asia, but apparently the connection between these continents was too far north to serve as a highway for any reptiles. Some examples of discontinuous distribution in the reptiles are, the Gila monsters (Helodermatidae), Texas, Arizona, Mexico, and Borneo; the large herbivorous iguanas, tropical America, Madagascar, and Fiji; the pythons, tropics of the Old World and western Mexico; and the burrowing *Amphisbaena*, South America and Africa. The true land tortoises (*Testudo*) are found in all tropical and warm temperate regions except Australia.

The amphibious reptiles, the crocodilians and the fresh-water turtles, present a more generalized distributional picture resembling that of the amphibians rather than that of the mammals presumably owing both to their greater age than mammals and the fact that aquatic habitats are much less variable than terrestrial, the chief differential here being extratropical changes in temperature. True crocodiles (*Crocodylus*), appearing first in the Cretaceous, still occur throughout the tropics. The gavials and alligators appear in the Miocene; the gavials are now confined to southern Asia, the alligators (with the caymans) to America, with one alligator in southern China. Among the

fresh-water turtles the soft-shelled type, appearing first in the Cretaceous, still occurs in Asia, Africa, and America, as far north as Canada; the Pelomedusidae are found in Africa and South America; and the snake-necked turtles in South America, Australia, and New Guinea.

Briefly stated, the history and present distribution of the reptiles seem to be dependent upon their special ecological characteristics, which differ from those of any of the other vertebrates in their dependence upon certain elements of sunlight and their relative independence of a constant supply of external water. Their former distribution is most closely parallel to that of the succeeding mammals, while their present distribution is mainly parallel to that of mammals with some forms having a distribution parallel to that of the amphibians.

ZOOLOGY.—Poritextularia, *a new Recent foraminiferal genus.*[1] ALFRED R. LOEBLICH, JR., and HELEN TAPPAN, U. S. National Museum.

During generic studies of the smaller Foraminifera, the writers have encountered numerous species that do not agree with the generic diagnosis of the genera to which they have been referred. In order that the foraminiferal genera should be more precisely defined, the writers are excluding many such species from genera that have already been well defined. In the present paper a new generic name is proposed for a species in the family Textulariidae which was previously referred to *Textularia panamensis* Cushman. In a recent article by Loeblich (1952, p. 190) it was inferred that this species might belong to *Tawitawia* Loeblich as it was very similar to the genotype species of *Tawitawia*. At that time, no specimens of the present form were available for study, but the writers have subsequently had the opportunity of examining a suite of specimens of this species. Although similar externally, the two species differ in both their apertural character and internal structure. The new genus *Poritextularia* here described, like *Tawitawia*, is a specialized off-shoot from *Textularia*, that has evidently developed in Recent times.

The writers are indebted to Dr. Irene McCulloch, Allan Hancock Foundation, University of Southern California, for making available a fine suite of specimens for study.

Family TEXTULARIIDAE

Genus **Poritextularia** Loeblich and Tappan, n. gen.

Genotype (type species): *Poritextularia mexicana* Loeblich and Tappan, n. sp.

Test free, compressed, biserial throughout; wall agglutinated, interior simple; aperture consisting in the early stages of an elongate slit at the base of the last chamber, paralleling the sides of the test, and in the adult consists of a linear series of openings across the terminal portion of the final chamber, formed by the development of piliars across the original slit.

Remarks.—This genus resembles *Textularia* Defrance in the biserial agglutinated test, but differs in having a multiple aperture. It resembles *Tawitawia* Loeblich in the large flattened biserial test with a rather extreme overlap of chambers and multiple aperture, but differs in having a simple interior, lacking the internal pillars and labyrinthic structure of the latter genus, and in being completely biserial with no tendency to become uniserial. The aperture of *Tawitawia* is completely terminal and does not extend to the base of the final chamber as in *Poritextularia*.

Poritextularia mexicana Loeblich and Tappan, n. sp.

Figs. 1–3

Textularia panamensis Cushman, Lalicker and McCulloch (not Cushman, 1918), Allan Hancock Pacific Exped. **6** (2): 136, pl. 15, figs., 18 a–e. 1940.

Test free, biserial throughout, rhomboid in outline, much compressed, sides flat; chambers numerous, low and broad, increasing gradually in size from the rounded proloculus, very oblique, highest at the mid portion of the test and bending downward to the margins; sutures distinct, depressed, strongly oblique, slightly curved upwards; wall finely arenaceous, with occasional large black mineral grains included (shown on final pair of chambers in Fig. 1 and to the right margin of Fig. 2), interior simple, not labyrinthic; aperture in the early stages consisting of an elon-

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gate slit at the base of the last chamber, paralleling the flat sides of the test, which in the adult may be bridged by pillars so that the former slit is broken up into a linear series of small pore-like openings extending from the base across the terminal portion of the final chamber.

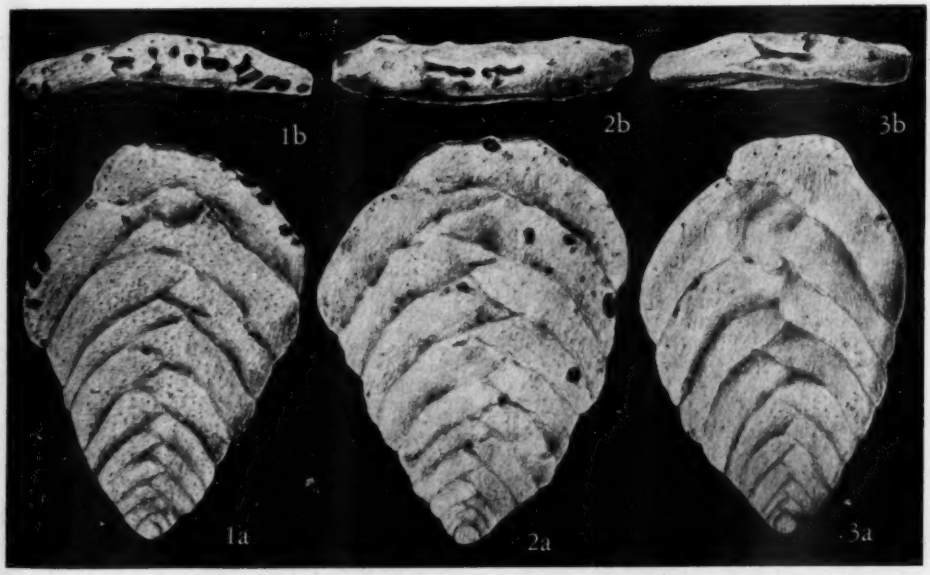
Length of holotype (Fig. 1) 1.85 mm, breadth 1.22 mm, thickness 0.23 mm. Length of paratype of Fig. 2 1.87 mm, breadth 1.43 mm, thickness 0.23 mm. Length of paratype of Fig. 3 1.82 mm, breadth 1.20 mm, thickness, 0.23 mm.

Remarks.—This species was described and illustrated by Lalicker and McCulloch (1940, p. 136, pl. 15, fig. 18) but was referred to *Textularia panamensis* Cushman. *Textularia espersoni* Applin was placed in the synonymy of *T. panamensis* in this publication, but the present writers believe Applin's species to be distinct from both Cushman's species and the present form. *Textularia espersoni* is a small, parallel-sided species with a diamond-shaped cross section, much thicker along the central zigzag suture than at the periphery. The chambers are comparatively high and produced into spines at the margins. The aperture is "a well-arched opening at the base of the last-formed chamber."

Textularia panamensis is larger than *T. espersoni*, has a rhomboid outline, but is extremely flattened, and the chambers are very low and broad. The aperture was described as "indistinct," but examination of additional specimens from the Miocene Gatun formation, near the Gatun Railroad Station, shows the aperture to consist of a well-defined triangular opening at the base of the last chamber, which does not extend far up the apertural face.

The species *T. panamensis* Cushman, 1918, and *T. espersoni* Applin, 1925, are both true *Textularia* and quite distinct from the present species, which has much more strongly overlapping chambers, a larger test approximately three times as large, and the aperture varying from a very elongate slit beginning at the base of the last chamber to a multiple aperture consisting of a linear series of openings.

Types and occurrence.—Holotype (USNM P.



FIGS. 1–3.—*Poritextularia mexicana* Loeblich and Tappan, n.sp.: 1a, side view of holotype (USNM P. 839) showing broad flat test, strongly overlapping chambers, and dark mineral grains on final two chambers; 1b, top view showing aperture beginning as an arch at the base of the chamber and extending as a linear series of pores across the top of the final chamber (four black mineral grains are present at the right side of the chamber nearly in line with the aperture and should not be confused with the aperture); 2a, side view of paratype (USNM P. 840 a); 2b, top view showing long slitlike aperture interrupted by a single pillar; 3a, side view of paratype (USNM P. 840 b); 3b, top view showing shorter slitlike aperture uninterrupted by pillars. (All figures camera-lucida drawings by Sally D. Lee, scientific illustrator, Smithsonian Institution.)

839) figured paratypes (USNM P. 840 a–b) and unfigured paratypes (USNM P. 841 a–e) all from Allan Hancock Expedition station 2060, Point Piaxtla, Sinaloa, Mexico, lat. 23°33′ N., long. 106°46′ W., in 8 fathoms.

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MALACOLOGY.—*A new glycymerid from the Western Atlantic.*[1] DAVID NICOL, U. S. National Museum.

While examining *Glycymeris americana* in the U. S. National Museum collection, I found specimens of an undescribed species of Recent glycymerid which had been labeled *G. undata* (Linné), *G. decussata* (Linné), *G. pennacea* (Lamarck), *G. lineata* (Reeve), and *G. americana* (Defrance). These many names indicate that the Western Atlantic glycymerids are in need of a thorough study.

I am greatly indebted to William J. Clench and T. E. Pulley, of the Museum of Comparative Zoölogy, for the loan of specimens for examination.

Glycymeris spectralis Nicol, n. sp.

Figs. 1, 2

Description.—Shell, with one exception, longer than high; ratio of convexity to height about 0.68; valve outline ovate to subtriangular, with the posterior side produced and commonly truncated; beaks opisthogyrate and located at about the posterior fourth of the ligamental area; umbos small; ligament small and short with about six ligamental chevrons which are better developed on the anterior side; hinge plate narrow; hinge teeth small, about 25 in number; radial ribs rather narrow, raised slightly, separated by narrow interspaces, ribs and interspaces covered by radial striae; periostracum well-developed, velvety; crenulations on inner ventral border large and widely spaced for the size of the shell, 6 or 7 per cm on specimens of from 20 to 25 mm in height; color pattern variable, some specimens show distinct rays of reddish-brown exteriorly; interior of some specimens may be white or light to dark brown, color better developed on the posterior side of the shell.

FIGS. 1, 2.—*Glycymeris spectralis* Nicol, n.sp., holotype (U.S.N.M. no. 598668), Recent, from Boynton on Lake Worth, Palm Beach County, Fla.: 1, Interior, right valve; 2, exterior, left valve. Natural size.

Measurements in mm.—The numbers that follow the words holotype and paratype are U. S. National Museum catalogue numbers.

	Height	*Length*	*Convexity*
Holotype 598668	19.2	20.5	13.0
Paratype 522645	22.0	21.8	14.4
Paratype 522645a	14.0	14.8	8.8
Paratype 223632	22.0	24.7	15.8
Paratype 223632a	21.6	23.4	15.2
Paratype 223632b	16.2	18.3	11.2
Paratype 223632c	17.0	19.1	11.7
Paratype 223632d	17.3	19.6	12.0
Paratype 36421	21.6	24.5	14.2
Paratype 36421a	20.6	21.2	14.4
Paratype 599298	17.7	18.4	11.3
Paratype 599298a	14.9	16.6	10.1
Paratype 599298b	13.2	14.2	8.0
Paratype 486218	15.2	16.7	9.9
Paratype 486218a	14.4	16.1	9.3
Paratype 36418	21.9	23.0	14.7
Paratype 92393	21.3	23.6	14.3
Paratype 598667	24.2	25.8	17.6
Paratype 486294	27.6	29.4	20.2
Paratype 406841	16.6	17.8	11.2
Paratype 406841a	15.2	15.9	9.2
Paratype 83135	5.2	5.9	3.6
Paratype 124780	20.5	22.8	15.7
Paratype 515910	19.7	20.3	13.9
Paratype 364579	22.9	25.2	17.0
Paratype 364579a	16.9	18.1	12.3
Paratype 364706	18.8	21.4	14.6
Paratype 364706a	17.6	19.2	12.8
Paratype 364706b	8.1	9.0	5.9
Paratype 543835	22.7	25.4	15.8
Paratype 543835a	20.6	22.4	13.5
Paratype 543835b	19.2	21.9	13.2
Paratype 543835c	18.8	21.1	11.8
Paratype 543835d	18.8	22.2	11.9
Paratype 543835e	15.0	16.8	9.9
Paratype 543835f	14.7	16.7	9.2
Paratype 543835g	15.5	14.9	8 7
Paratype 486540	16.6	18.0	11.1

Types.—Holotype, U.S.N.M. no. 598668 (Division of Mollusks). There are 37 paratypes in the

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U. S. National Museum collection; for catalogue numbers see under *Measurements*. The Museum of Comparative Zoölogy at Harvard College has 50 paratypes of *Glycymeris spectralis*.

Comparisons.—*Glycymeris spectralis* can be distinguished from *G. americana* (Defrance) by the more prominent and narrow radial ribs, the produced and commonly truncated posterior side of the valves, and the more strongly opisthogyrate beaks. It can be differentiated from *G. undata* (Linné) = *G. lineata* (Reeve) by the opisthogyrate beaks and the more prominent and narrow radial ribs. *G. spectralis* can be distinguished from *G. decussata* (Linné) = *G. pennacea* (Lamarck) by the narrower and more prominent radial ribs and by the wider-spaced and less numerous crenulations along the interior margin.

Geographic distribution.—The holotype was collected at Boynton on Lake Worth, Palm Beach County, Fla. The northernmost locality for *Glycymeris spectralis* is Shackleford Island, which lies immediately west of Cape Lookout, N. C. Several lots were taken from around Cape Fear, N. C. The species is common along the east coast of Florida as far south as Miami, but only one specimen has been noted from the west coast of Florida (Lemon Bay). There are no records of *G. spectralis* north of Lemon Bay and around the Gulf coast to Tampico, Mexico. At Tampico this species is common, and it occurs as far south as the Bay of Campeche. There are three lots of specimens from the north coast of Honduras and one from San Juan del Norte (Greytown), Nicaragua, in the U. S. National Museum collection. The distribution of *G. spectralis* is plotted on a map, Fig. 3. Further collecting will probably fill in some of the gap between Tampico, Mexico, and Lemon Bay, Fla. *G. spectralis* has not been found in the West Indies, including the Bahama Islands; this species appears to be confined to shallow water off the mainland of North and Central America.

Habitat.—*Glycymeris spectralis* has been collected from a sandy bottom. The most common depths from which this species has been dredged are from 16 to 18 meters, but it has been found at depths ranging from 1 to 26 meters.

FIG. 3.—Geographic distribution of *Glycymeris spectralis*, n.sp.

ICHTHYOLOGY.—*Revision of the genus* Talismania, *with description of a new species from the Gulf of Mexico.* A. E. PARR, American Museum of Natural History. (Communicated by Leonard P. Schultz.)

The segregation of *Nemabathytroctes* from *Talismania* has always rested almost exclusively upon the presence of produced fin rays at least in the pectorals of the former. In 1951 the writer (Parr, 1951, p. 11) restricted *Talismania* to the genotype, *T. homoptera* (Vaillant, not *T. homoptera* of other authors), with the other species usually identified as *T. homoptera* transferred to the family Searsidae, and those referred to the genus *Talismania* under other specific names placed in the genera *Rondeina* and *Binghamichthys*. Thus restricted, *Talismania* agreed with *Nemabathytroctes* in all basic features, such as the length of the snout, lateral dentition of premaxillaries, and structure of opercular bones. But a fairly sharp distinction still existed between the two species referred to *Nemabathytroctes* and the only recognized species of *Talismania*, in regard to the size of the head, the dimensions of the jaws, the apparent form (depth) of the body, and other features (see the key on p. 269). With the type of *T. homoptera* no longer giving any evidence of produced pectoral rays, the generic identity of this genus and species with *Nemabathytroctes* therefore still remained unsuspected.

The discovery of another new species, unquestionably representative of *Nemabathytroctes*, but with heads and jaws in the proportions characteristic of *Talismania homoptera*, and with the produced rays of pectoral fin relatively weaker and less thickened than in the other species of *Nemabathytroctes*, has now given new significance to Vaillant's previously neglected description of the pectorals of *T. homoptera* as being elongated so as to reach to, or even beyond, the insertion of the ventrals. It is therefore now obvious that *Talismania* and *Nemabathytroctes* are identical genera, differing only by their type species but not by any characters of generic significance.

The relatively slender body measurements of *T. homoptera* are governed by the dimensions of the soft parts only and can be largely explained by the state of the specimen, in which the stomach is missing and the other soft parts seem shrunken or in a naturally poor state of nutrition.

The great over-all length of the head in *T. bifurcata* is largely due to the long dermal flap of the gill cover, which extends well beyond the insertion of the anterior (upper) ray in pectoral fin. When skeletal measurements are used, such as the distance from the snout to top of preopercle, the differences between the various species in regard to the general size of the head become less clear and significant, and one can only say that snout to preopercle is more than (28 − .02L) percent of L in *T. longifilis*, less than (28 − .02L) but more than (25 − .02L) percent of L in the other species. A similar situation obtains in regard to the distance from snout to pectorals, which is more than (42 − .02L) percent of L in *T. longifilis*, less than (41 − .02L) but more than (38 − .02L) in the others.

There is undoubtedly a valid difference between *T. bifurcata* and *T. oregoni* in regard to the length of the dermal flap of the gill cover, and thus also in regard to the over-all length of the head. But the size of the dermal flap of *T. homoptera* can unfortunately not be determined with any degree of certainty in the present state of the type specimen.

It is, therefore, in the dimensions of the jaws relative to each other and to the length of the specimen, rather than in the general dimensions of the head, that we find the most significant and useful proportions for the differentiation of the species, in correlation with other features.

Genus **Talismania** Goode and Bean, 1895

Bathytroctes, subgenus *Talismania* Goode and Bean, 1895, p. 43 (*partim*, genotype, *B. homopterus*, only); *nec* Norman, 1930, p. 269; *nec* Fowler, 1934, p. 249.

Talismania Jordan and Evermann, 1896, p. 455 (*T. homoptera*, only); Roule, 1919, p. 6 (*T. homoptera*, only); Parr, 1951, pp. 5, 11; *nec* Koefoed, 1927, p. 55.

Bathytroctes, subgenus *Nemabathytroctes* Fowler, 1934, p. 252.

Nemabathytroctes Parr, 1937, p. 7; Parr, 1951, pp. 5, 10.

Pectorals with 11–12 rays, upper ray greatly produced. Dorsal and anal fins subequal and approximately opposite. Caudal fin with produced lobes (in the species in which the caudal fin has been preserved). Ventral fins inserted near the middle of the length, with 6–7 rays.

Heads large, not less than (38 − .02L) percent of L. Snouts long, 10–12, or more than ? (13 − .02L) ?, percent of L. Mouth large, lower jaws more than (20 − .02L) percent of L. Premaxillaries of normal shape but with a short external series of horizontal teeth anteriorly, well above the regular dentition at the edge of the mouth. Teeth otherwise in single series in premaxillary, maxillary, lower jaw and palatine, and in one or two transverse rows on vomer. Maxillary series as long as, or longer than that of the premaxillary. Two supramaxillaries, with slight or no mobility relative to maxillary.

Head pointed in lateral view, with a virtually straight dorsal profile ending at a slightly prominent snout, marked by the upper, horizontal dentition of the premaxillaries.

Gill opening wide, extending upward to, or nearly to, the level of the upper margin of orbit. Operculum moderate to large, extending well above its attachment to hyomandibular. Subopercular large, varying in form with the species. Interoperculum normal. Preoperculum rather wide, its upper limb subvertical. Branchiostegals 6–8.

Stomach siphonal; 8–10 simple pyloric caeca. Anus near anal fin.

Body scaly, head without scales. No shoulder organ. Apparently luminous organs present in orbital cavity of at least one species.

Our knowledge of the genus is based upon only five specimens of the following sizes and sex: *T. longifilis* 116 mm L (i.e., length without caudal fin), immature. *T. homoptera* 161 mm L. Internal organs missing. *T. bifurcata* 202 mm L, mature female. *T. oregoni* 240 and 246 mm L, mature females.

These dimensions should be borne in mind in evaluating the statements of relative proportions given in the following key by use of the expressions proposed by Parr, 1949.

The condition of the type specimen of *T. homoptera* leaves the exact form of the posterior margin of the subopercle in doubt. It can be definitely established only that the lower posterior corner of the subopercular ends rather bluntly with a group of 3 or 4 very short and fine points, side by side at its tip. It is indicated that this species may not have any of the very long, widely separated, simple points higher up along the posterior margin of the subopercle, that seem characteristic of the other members of the genus, but the writer is not satisfied that this can be taken to be definitely proven by the type specimen as observed by him.

KEY TO THE GENUS TALISMANIA

A. Heads large, more than (41 − .02L) percent of L. Jaws very long, upper jaws about (23 − .02L), lower jaw (24.5 − .02L) percent of L. Produced pectoral rays very strong. Indo-Pacific.
   1. Scales small, 90–95 in a longitudinal series, about 35 in a transverse count. Subopercular with three separate points. Head about (41.5 − .02L) percent of L. Gulf of Aden. *longifilis* (Brauer, 1902)
   2. Scales larger, about 65–70 in a longitudinal series, about 22–23 in a transverse count. Subopercular with only two long points. Head about (42.1 − .02L) percent of L. Gulf of Panama. *bifurcata* (Parr, 1951)

B. Heads smaller, less than (40 − .02L) percent of L. Jaws much shorter, upper jaws less than (21 − .02L), lower jaw less than (21.5 − .02L) percent of L. Scales large, about 60–65 in a longitudinal series and about 20–24 in a transverse count. Produced pectoral rays not very strong. Atlantic.
   1. Upper jaws extend beyond centre of eye but fall conspicuously short of reaching the vertical from the posterior margin of orbit, being about 2 percent of L shorter than lower jaw. Ventrals slightly behind the middle of body, snout to ventrals about 17 percent of L longer than snout to pectorals. Dorsal fin with only about 19 rays, its base about 2 percent of L shorter than base of anal fin. Eastern North Atlantic. *homoptera* (Vaillant, 1888)
   2. Upper jaws extend nearly to vertical from posterior rim of orbit, being less than 1 percent of L shorter than lower jaw. Ventrals slightly in advance of the middle of body, snout to ventrals only about 12.5 − 14.5 per cent of L longer than snout to pectorals. Dorsal fin with 23 or 24 rays, its base not more than 1 percent of L shorter than the base of anal fin. Gulf of Mexico..... *oregoni*, n. sp.

Talismania oregoni, n. sp.

Jaws relatively short, but upper jaw less than one (.5–.8) percent of L shorter than lower jaw, equivalent to (20 − .02L) percent of L. Lower jaw equivalent to (20.5 − .02L) to (21.4 − .02L) percent of L. Upper jaw extends nearly to the vertical from the posterior rim of orbit. Head moderate, with rather short dermal flap of gill-cover, equivalent to (38 − .02L) to (39.8 − .02L) percent of L.

Subopercle ends posteriorly in three long separate points. Lower margin of lower subopercular point with minute, oblique serrations. Interorbital space flat.

Ventrals inserted slightly in advance of the middle of body, their distance from the snout only 12.5–14.5 percent of L longer than the distance from snout to pectorals. The longest remaining fragment of the produced pectoral finray equals about 35 percent of L. The full length of the produced ray would undoubtedly be substantially greater, although the proximal part is not particularly strengthened and thickened. The form of the caudal fin is unknown. The bases of dorsal and anal fins are about 19–21 percent of L.

The specimens show the following measurements and proportions, with those of the cotype given in parenthesis: Length without caudal fin: Type 240 mm (cotype 246 mm). Proportions in percent of length without caudal: Head, including dermal margin of gill cover, 35.0 (33.3). Snout 11.1 (10.2). Orbit 5.5 (5.7). Interorbital width 6.3 (5.4). Over-all length of upper jaws 15.8 (15.0). Lower jaw to external corner of angular 16.6 (15.5). Snout to top of preopercle 21.8 (20.3). Snout to dorsal fin 62.9 (64.5). Snout to anal fin 63.6 (62.9). Snout to pectorals 35.8 (33.2). Snout to ventrals 48.3 (47.7). Base of dorsal fin 20.4 (18.9). Base of anal 20.0 (20.7). Greatest depth of body 22.7 (22.3). Least depth of caudal peduncle 8.5 (8.1).

D. 22½–24½. A. 23–23½. P. 12. V. 7. Br. 6–7. First gill arch with 7–8/1/17–18 gill rakers, longest only about 3.3 percent of L.

Stomach siphonal; 8 or 9 simple pyloric caeca, the longest 8.7–10.6 percent of L, substantially longer than those found in *T. longifilis* and *T. bifurcata*, but the significance of this difference is uncertain.

About 51 pores in lateral line, about 63–64 scales in a longitudinal series immediately above, about 11 between lateral line and origin of dorsal fin, and about 12 between lateral line and anal fin. There is no clear evidence of ventral or dorsal keels, except immediately before dorsal fin. But two median ventral scales preserved in the thoracic region suggest the presence of some kind of organ surrounded by black integument under the broad posterior point of each, while a single scale still present outside of the median shows only a narrow, black tip. No indications of whitish, luminous (?) bodies in orbits.

Gulf of Mexico. *Oregon* station 349. 29°09′ Lat. N., 87°58′ long. W. Depth 470–500 fathoms. May 21, 1951. Holotype, U.S.N.M. no. 160482. Cotype no. ?.

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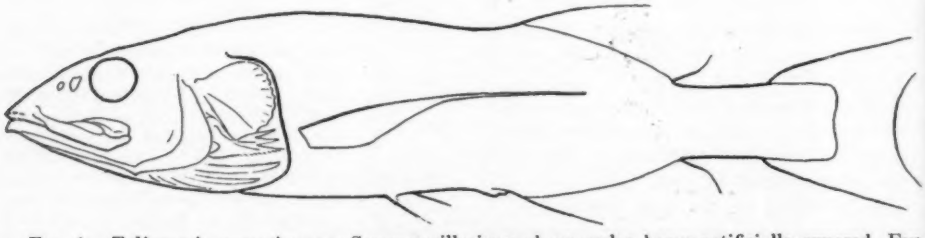

FIG. 1.—*Talismania oregoni*, n.sp.: Supramaxillaries and opercular bones artificially exposed. Eye represented by orbit. Drawn by author.

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PROCEEDINGS OF THE ACADEMY

456TH MEETING OF BOARD OF MANAGERS

The 456th meeting of the Board of Managers, held in the Cosmos Club on May 12, 1952, was called to order at 8:02 P.M. by President RAMBERG. Others attending were: H. S. RAPPLEYE, J. A. STEVENSON, W. F. FOSHAG, A. T. MCPHERSON, C. F. W. MUESEBECK, R. G. BATES, W. R. WEDEL, W. A. DAYTON, C. A. BETTS, R. S. DILL, F. W. HOUGH, N. R. ELLIS, M. A. MASON, F. M. DEFANDORF, and, by invitation, E. H. WALKER and J. P. E. MORRISON.

The President announced the appointment of WALLACE R. BRODE as Chairman of the new Science Education Committee, other members to be announced at a later date.

A letter from the Chairman of the Committee on Meetings, HARRY W. WELLS, who could not be present, was read, requesting a change in the next meeting date to the fourth Thursday in October. This change in lieu of the regular meeting date on the third Thursday was approved by the Board, as it will insure a joint meeting with the Anthropological Society to be addressed by Dr. C. E. WILLIAMS.

MARTIN A. MASON reported mentioning the desire on the part of the Academy to collaborate with its Affiliated Societies at a meeting of the Council of the Civil Engineering Society. After the meeting Colonel Hough reported that he also had taken the matter up with the Society of Military Engineers and that they would be glad to take part in a joint symposium should such be arranged. Presumably this matter will be revived for discussion when meetings of other Affiliated Societies are resumed in the fall.

Mr. WALKER expressed his regrets that new members do not receive something other than a letter when they are first elected and actually know very little about the Academy and its aims. During the ensuing discussion by Messrs. Mason, Rappleye, Betts, Dayton, and others it was indicated that the proposed supplemental list of members since the last issue of the Red Book (no longer available for distribution), although of use to those owning the last Red Book, would not be especially useful or its receipt gratifying to newly elected members. In addition to a complete Academy membership list, it would be desirable to have the Bylaws, something of the history, objectives, and aims of the Academy, and information as to the relationship of the Affiliated Societies, in printed form. The matter of the cost and labor of preparation involved was mentioned. The discussion was concluded by approval of a motion by Mr. Mason that the matter be referred to the Policy and Planning Committee to report at the first meeting in the fall their recommendations as to how new members should be initiated and what they should receive.

L. E. YOCUM, Chairman of the Committee on Grants-in-Aid for Research, on the basis of approval of his committee at a meeting on April 29, submitted a recommendation that an American Association for the Advancement of Science grant of $200 be made to Dr. FREEMAN A. WEISS, curator of the American Type Culture Collection, for purchase of equipment to permit an examination of the Lederberg Process of preserving bacterial cultures by drying on silica gel. Details of the proposal were submitted. This grant was approved by the Board.

MARTIN A. MASON, Chairman, presented copies of a report for his Committee on a Junior Academy of Sciences. This report and the appended proposed Constitution and Bylaws for the Junior Academy were discussed by Messrs. Rappleye and McPherson. In view of the present Bylaws of the Academy, it was decided to submit to the membership an amendment to Article I, adding to it as one of the listed objectives a section "9. Sponsoring the Washington Junior Academy of Sciences" and a second permissive

amendment, Article XI, "The Academy may establish and assist a Washington Junior Academy of Sciences for the encouragement of interest in science among students." It was decided that a ballot for these amendments should be sent out within two weeks together with explanatory material and, for the information of the membership, a copy of the committee's report and the proposed Constitution and Bylaws for the Washington Junior Academy of Sciences.

The Secretary announced the receipt of notification of the death of Dr. GEORGE W. MCCOY on April 2, 1952.

The Secretary reported for Vice President A. G. MCNISH, who was unable to attend the meeting, that the Philosophical Society of Washington had appointed a special committee composed of WILLIAM R. DURYEE (Chairman), I. C. GARDNER, and R. K. COOK to study and make recommendations as to suitable projection equipment and a suitable public address system for equipping the new Auditorium of the Cosmos Club which is expected to be available for use in the fall. It was felt that the Academy and a number of its Affiliated Societies that will make use of the Auditorium will be interested in having excellent facilities available, and may therefore be interested as a group in providing desirable equipment. After a discussion, the President suggested that the Chairman of the Meetings Committee, HARRY W. WELLS, look into the matter with Mr. Duryee and express the interest of the Academy in this project.

J. A. STEVENSON, Archivist, commented that he found the reading of the early bound records of the Academy, turned over to him at the last meeting of the Board, very rewarding and mentioned several items of interest.

The meeting adjourned at 9:35 P.M.

F. M. DEFANDORF, *Secretary.*

Obituary

OSCAR BENWOOD HUNTER died suddenly at Washington, D. C., on December 19, 1951, of a heart attack. He was born in Cherrydale, Va., on January 31, 1888. He received his medical degree from the George Washington University School of Medicine in 1912. In 1916 he received an A.B. degree and the following year an A.M. degree, both from the George Washington University. He served his alma mater as professor of bacteriology and pathology from 1916 to 1932 and assistant dean of the medical school from 1918 to 1932. He was an active member of numerous scientific societies where he served in official capacities. He was past president of the Southern Medical Association, Medical Society of the District of Columbia, the George Washington University Medical Society, Washington Society of Pathologists and the American Therapeutic Society. He was also a founding member of the College of American Pathologists and served this college as local governor. Dr. Hunter was also a member of numerous other organizations, including many local clubs, the National Safety Council, Board of Trade, and the Chamber of Commerce of the United States. He served as major in the medical reserve corps, U. S. Army. At the time of his death he was vice-president of the American Medical Association.

WALTER A. BLOEDORN.

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